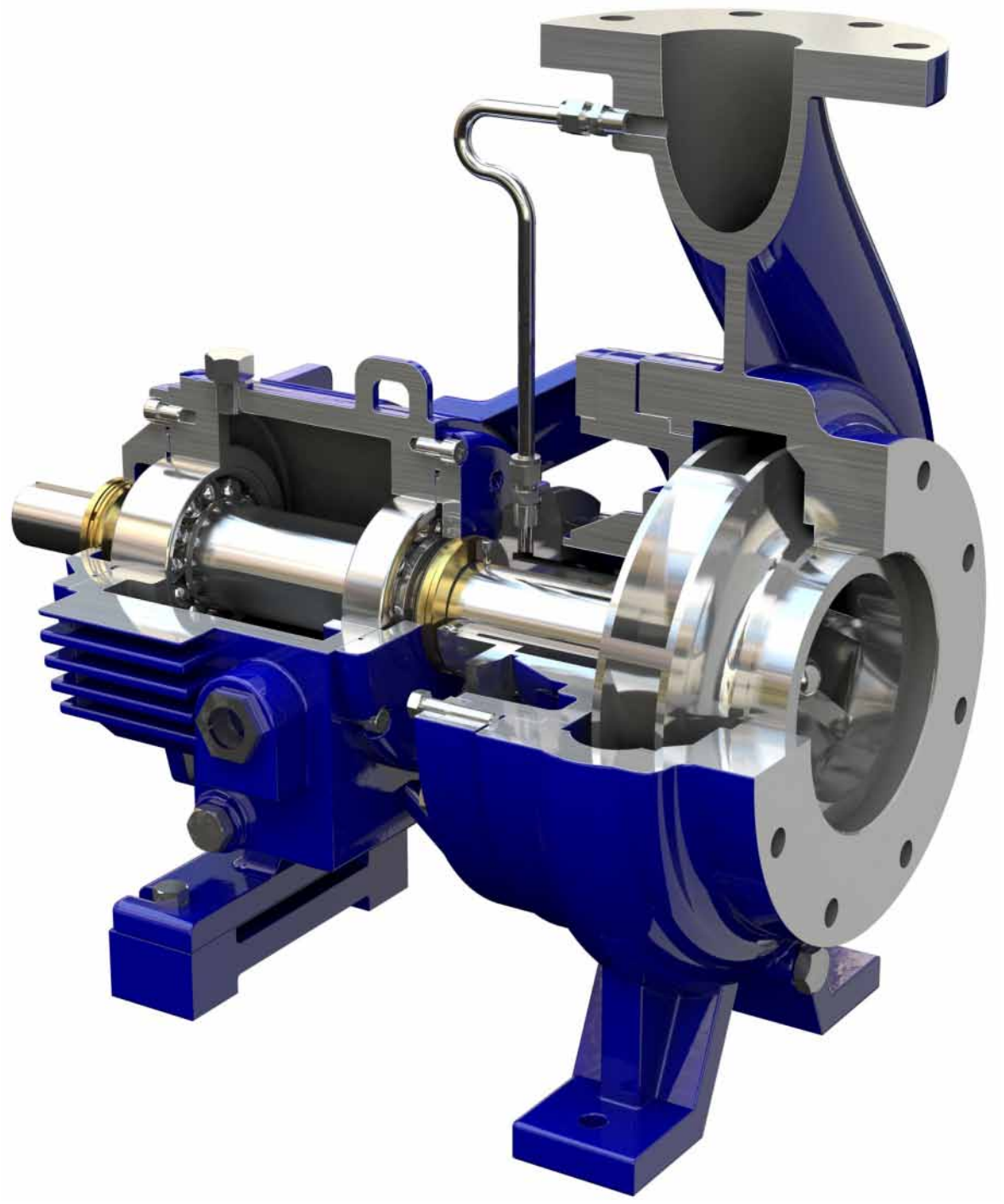
RUHRPUMPEN

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

CPP
Horizontal End Suction, Heavy Duty, Single Stage ANSI Chemical Process Pump
ANSI/ASME B73.1 – 2001



FOREWORD

These units are horizontal process pumps of the overhung power frame configuration and identified by Ruhrpumpen as CPP. This pump family is divided into 2 lines, the CPP21 line meets the ANSI/ASME B73.1 – 2001 requirements, and the CPP-L line is a solution for low flow and high head applications.

It is recommended that the services of a Ruhrpumpen installation technician be employed for the installation and initial starting of the pump. Such service will help to ensure the user that the equipment is properly installed, and will provide an excellent opportunity for the plant operator to receive useful tips and guidelines relative to the unit. The tools and/or equipment referenced in this manual are not supplied by Ruhrpumpen unless specifically ordered. This pump design can be serviced with standard maintenance tools.

Instructions in this manual are written for trained, experienced technicians who are familiar with the basic principles and tools involved in the installation, care and service of a pump and who, as part of their trade education have acquired the ability to interpret and follow the detailed specifications required for such installation, care, and service. Successful operation of the unit is dependent on careful study of the manual and a well-planned maintenance program.

A complete reading of this manual by personnel in contact with the pump is essential to safety. Incorrect installation, operation or maintenance can result in personal injury or death to personnel and damage to the pump and plant.

Before performing any service function be certain that the unit is separate from its power source or that the power source is locked out to prevent any form of energy from entering the equipment.

Contact with hot surfaces of the pump can cause severe burns. Care must be taken where such surfaces are exposed. Care must also be taken to prevent ignition of flammable fluids or other material.

Information in this manual is believed to be reliable, but it is not guaranteed by Ruhrpumpen as to its completeness or accuracy.

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SECTION ONE - PRODUCT DESCRIPTION

These operating instructions contain important information about the installation, operation and service of the unit. It is therefore imperative that the installing engineer and the responsible specialist/operating personnel read and understand these operating instructions before installation and commencement of operation.

This manual must always be available in the operational area of the machine/plant.

Please contact a Ruhrpumpen representative should problems arise. The pump may only be opened by a Ruhrpumpen approved technician during the guarantee period.

In case of queries, please have your project number and type designation of the pump available. You can find both of these on the first page of these operating instructions or on the rating plate fixed to the pump.

When ordering spare parts we would further request that you give the description of the required parts, together with their part numbers and identity numbers. You can find these on the sectional drawing and spare part list enclosed.

1.1 INTRODUCTION

Ruhrpumpen pumps of type CPP are centrifugal pumps of the horizontal, vertically (radially) split case, foot mounted heavy-duty construction with an overhung impeller, and are designed to meet the requirements of ANSI/ASME B73.1 – 2001. These pumps are designed for continuous duty pumping of various fluids with combinations of metallurgical, mechanical, and installation features for application in water, chemical and industrial service.

The CPP is a single stage, end suction pump. For these pumps, rotation is clockwise as viewed from the driver (coupling) end.

A spacer coupling is provided for accessibility of service and maintenance. The spacer permits back pull-out, that is, complete removal of the rotating element without disturbing the piping or driver.

The following information is included in the nameplate of your pump unit:

- Serial number
- RPM
- Head
- Capacity
- Impeller diameter

Please provide the pump Serial number when ordering parts; the information in the nameplate is relevant in some sections of this manual to ensure safe operation of this pump.

1.2 PUMP CASE, IMPELLER, AND WEAR RINGS

1.2.1 Pump Case

The pump case is feet mounted.

1.2.2 Impeller and Wear Rings

The impeller is dynamically balanced. The balancing is either single or two-plane, to meet the requirements of ISO 1940 Grade 6.3. The impeller is threaded to the shaft.

1.3 CASE COVER

The case cover is designed to accept a wide variety of single or double mechanical seals and to comply with ASME B73.1 – 2001 dimensional requirements.

When the pump is ordered with the cooling jacket option, the case cover is specially machined with connections for a cooling liquid. This is shown on the next figure.

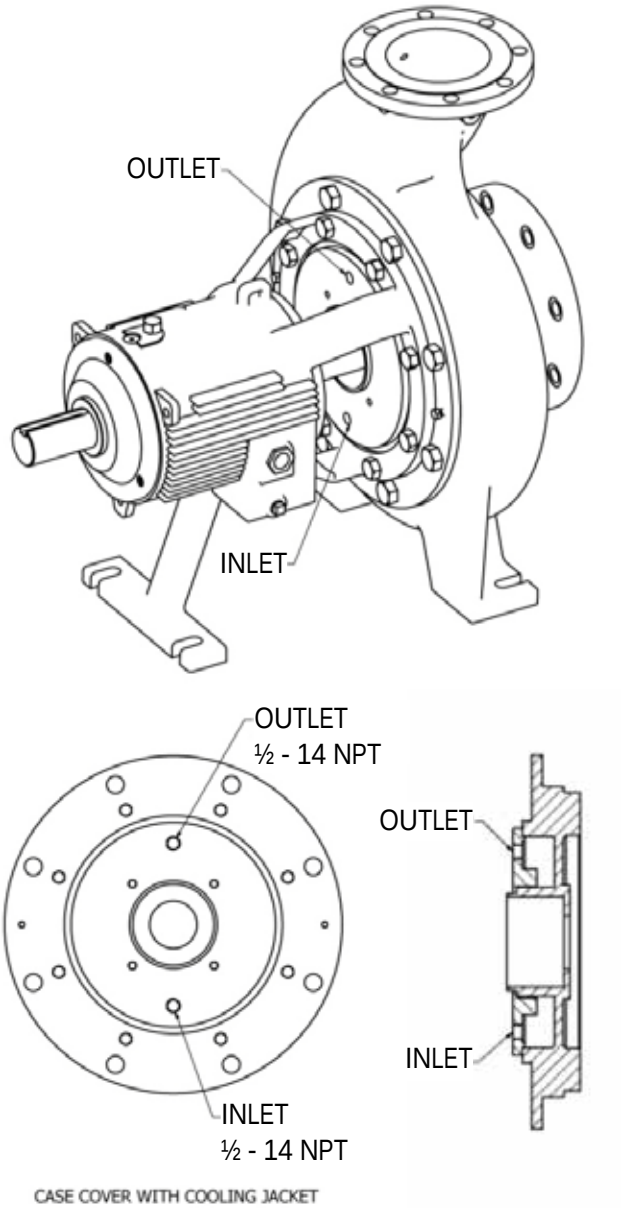


Figure 1.1 Cooling jacket special machining on case cover.

Please identify correctly the inlet and outlet connections for the coolant's piping when installing the auxiliary piping for the pump. Both connections are ½ inch – 14 NPT.

1.4 BEARING FRAME

The bearing frame, which also serves as a large reservoir for oil lubrication, encloses the two ball type angular contact thrust and deep groove ball radial bearings. The bearing frame, closed at each end by a cover and lip seal or labyrinth seal, is cast with fins for air cooling but optional water cooling is available.

Frame	Radial (Deep groove ball bearing, single row)	Thrust (Angular contact ball bearing, double row)
10 *	6208	5307 NR
30A	6310	5310 NR
30B *	6311	5310 NR
50	6314	5314 NR

* In CPP-L pump line, thrust bearings for frames 10 and 30B are 5307 and 5310 respectively.

When purge or pure oil mist is specified, appropriate connections will be identified on the bearing frame. See *SECTION SIX - LUBRICATION* for more details.

When water cooling is specified, a cooling coil is used.

SECTION TWO - SAFETY

This operation manual gives basic instructions that should be observed during installation, operation and maintenance of the pump. It is therefore imperative that this manual be read by the responsible personnel/operator prior to assembly and commissioning. It must always be kept available at the installation site. Not only are the general safety instructions contained under this *SECTION TWO - SAFETY* that must be observed but also the specific information provided in other sections.

2.1 IDENTIFICATION OF SAFETY INSTRUCTIONS IN THE OPERATING MANUAL

Safety instructions given in this manual whose non-compliance would affect personal and equipment safety are identified by the following symbol.

Where electrical safety is involved, the following symbol is shown.

The 

symbol is inserted in safety instructions whenever non-compliance might endanger the machine or its function.

It is imperative that signs affixed to the machine are observed and kept legible, for example:

- arrow indicating the direction of rotation
- symbols indicating fluid connections

2.2 QUALIFICATION AND TRAINING OF OPERATING PERSONNEL

The personnel responsible for operation, maintenance, inspection and assembly must be adequately qualified. The responsibilities and supervision of the personnel must be exactly defined by the plant operator. If the staff does not have the necessary knowledge, they must be trained and instructed. Training may be performed by a Ruhrpumpen representative on behalf of the plant operator. Moreover, the plant operator is to make sure that the contents of the operating manual are fully understood by the personnel.

2.3 HAZARDS IN THE EVENT OF NON-COMPLIANCE WITH THE SAFETY INSTRUCTIONS

Non-compliance with the safety instructions may produce a risk to the personnel as well as to the environment and the unit and results in loss of any right to claim damages.

Non-compliance may involve the following hazards:

- Risk of injury or death.
- Failure of important functions of the machine/plant.
- Exposure of people to electrical, mechanical, chemical, and thermal hazards.
- Endangering or damaging the environment due to hazardous substances being released.

2.4 COMPLIANCE WITH REGULATIONS PERTAINING TO SAFETY AT WORK

When operating the pump, the safety instructions contained in this manual, the relevant national accident prevention regulations, local and federal health and safety regulations, quality system requirements, and any other service and safety instructions issued by the plant operator must be observed.

2.5 SAFETY INSTRUCTIONS RELEVANT FOR OPERATION

- If hot or cold machine components involve hazards, they must be guarded against accidental contact (attach warning signs).

- Guards for moving parts (e.g. coupling) must not be removed from the machine while in operation (mounting must be possible only with tools).

- Any leakage of hazardous fluids must be drained away to prevent any risk to persons or the environment. Statutory regulations are to be complied with.

- Hazards resulting from electricity must be prevented.

2.6 SAFETY INSTRUCTIONS RELEVANT FOR MAINTENANCE, INSPECTION AND ASSEMBLY WORK

It is the plant operator's responsibility to ensure that all maintenance, inspection and assembly work is performed by authorized and qualified personnel who have adequately familiarized themselves with the subject

in matter by studying this manual in detail.

Any work on the machine shall only be performed when it is at a standstill. To shut off the machine it is imperative to follow the procedure for shutting down the machine as described in *SECTION 7.5-STOPPING*.

Pumps and pump units that convey hazardous materials must be decontaminated before any maintenance work is performed.

On completion of work all safety and protective facilities must be re-installed and made operative again.

Prior to restarting the machine, follow the instructions listed under *SECTION 7.2-STARTUP*.

2.7 UNAUTHORIZED ALTERATIONS AND SPARE PARTS

Modifications may be made to the machine only after consultation with a Ruhrpumpen representative.

Using spare parts and accessories authorized by Ruhrpumpen is in the interest of safety. The use of parts not authorized by the dealer exempt the manufacturer from any liability, voiding the warranty.

2.8 UNAUTHORIZED MODES OF OPERATION

The reliability of the machine is guaranteed if and only if it is used in the intended manner, in accordance with the statutes of this manual. The limit values specified in the data sheet must never be exceeded under any circumstance.

SECTION THREE - TRANSPORT & STORAGE

3.1 SHIPPING ARRANGEMENTS

The pump, coupling hub, and driver are generally shipped mounted on the baseplate.

A wooden skid is furnished for support and ease of transportation. Other required items (e.g. coupling, hardware, spare parts, etc.) are boxed or secured to the skid.

3.2 UNLOADING AND CHECKING EQUIPMENT

The following steps should be completed for all pumps when received.

1. Handle all equipment carefully.
1. Remove unit only by properly supporting the wooden shipping skid.
2. After unloading, inspect the pump, check the shipment against the packing list, and report damages or shortages immediately to freight carrier and to the designated Ruhrpumpen representative.

- Do not place lifting rig around bearing frame or under baseplate. Do not use the eyebolt at the top of pump and bearing frame to lift unit.

3.3 TRANSPORT

- To avoid damage, the unit must be transported and handled with care. It should be gently lowered onto an even surface. Pay attention to and indentify the signs marking the points of equilibrium and fastening places for ropes, or the openings for forklift trucks.

- Observe the plant's safety precautions when lifting heavy components.

- When transporting with a crane, the rope should be slung round the unit as shown below in Figure 3.1.

- The rope should not be slung around the lugs attached to the motor or around the lugs attached to the pump.

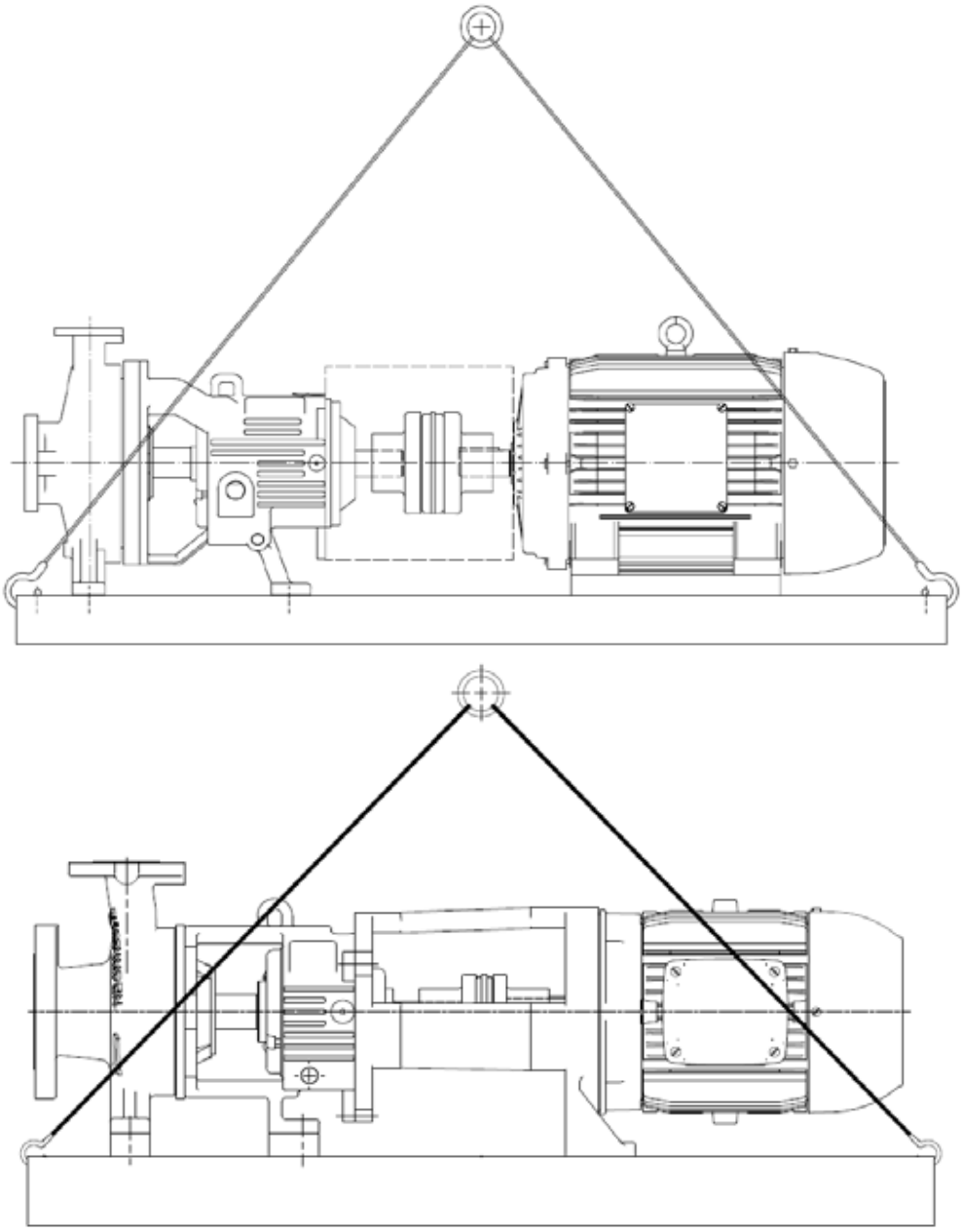


Figure 3.1. Correct position of the lifting ropes or chains, side view without and with C-Frame.

3.4 STORING

If the pump is not installed immediately (within one month after shipping date), it should be safely stored prior to installation in a dry location free of dirt and grit. Furthermore, the pump unit (pump, driver, etc.) should not be subject to sudden temperature changes or vibrations.

Observe the following steps:

1. Remove pump from shipping crate, but do not damage the crate because the unit is to be reboxed.
2. Remove all instruments and mechanical seal; store them safely.

3. Plug the instrument taps.
4. Thoroughly dry the pump with hot air.
5. Any painted surface damaged in shipment should be repainted or sprayed with oil.
6. Keep the pump moisture-free by the following two means:
    a. Spray the pump case, bearing frame with acid-free, moisture-free, protective oil or kerosene.
    b. Place desiccant or humidor bags inside the suction and discharge areas of the pump.

· Attach red tags with a "Remove Moisture Absorbent Material Bags Prior to Installing" to warn about the presence of this desiccant material.

7. Cover all the openings with plywood or metal covers. Recheck the condition of these covers every month and replace as necessary.
8. If the pump's external parts have protective coatings, periodically inspect and renew the coating as required.
9. Rotate the shaft 1 ¼ revolutions every week. Lubricate shaft bearings prior to rotation.

· The client must keep a record of the weekly rotation of the shaft. Failure to document and present these records as evidence will void the warranty.

10. Check the packaging for damage every month.
11. Ensure pump flange covers remain in place.
12. Return the unit to the shipping crate.
13. When the pump is to be installed, remove all the protective coatings and desiccant or drain all oils.

One month before installation, a Ruhrpumpen representative should be employed to conduct a final inspection.

To properly store the motor (driver) for periods longer than one month, follow these steps:

1. Store the motor in a clean, dry area, or cover it with a loose tarp (the tarp must be loose in order to prevent condensation).
2. Exercise precautions to avoid transit or nesting of rodents, snakes, birds, and insects.
3. Inspect and, if necessary, recoat the rust preventive coating of external machined surfaces.
4. Fill with lubricant the grease-lubricated cavities of the motor, but first remove the drain plug and fill the cavity until the grease starts to purge.

· Follow the instruction manual of the driver manufacturer to ensure the lubrication is performed properly.

5. Upon receipt, considering that the oil-lubricated drivers are not shipped oil-filled, fill the reservoir to maximum level with properly selected oil with rust and corrosion inhibitors.

· Always drain the oil before moving the pump, to avoid any damages, and refill the motor on its new location.

6. Rotate the shaft of the motor once a month.
7. Some form of heating must be used to prevent condensation. This heating should maintain the winding temperature at a minimum of 9 °F (5 °C) above the surrounding ambient temperature. There are three options:

o If space heaters are supplied, they should be energized.

o If none are available, single phase or “trickle” heating may be utilized by energizing one phase of the motor’s windings with a low voltage, producing heat in the winding conductor.

· Request the required voltage and transformer capacity from the driver manufacturer.

o A third option is to use an auxiliary heat source and keep the windings warm by either convection or blowing warm dry air into the motor.

· Be careful not to overheat, since keeping the temperature of the motor frame 9 °F (5 °C) above the surrounding ambient temperature is sufficient.

After the storing period, follow the next steps as start-up preparations:

1. Motor should be thoroughly inspected and cleaned to restore to an “As Shipped” condition.
2. Motors, which have been subjected to vibration, must be disassembled and each bearing inspected for damage.
3. Oil and/or grease must be completely changed using lubricants and methods recommended on the motor's lubrication plate, in the “LUBRICATION” section of the driver manufacturer’s manual.
4. If storage has exceeded one year, the motor manufacturer’s Quality Assurance Department must be contacted prior to equipment start-up for any special recommendations.

3.5 CONSERVATION

All exposed, machined, working surfaces (flanges, seals, surfaces supporting the motor), shaft ends, unpainted couplings and the like have been cleaned and treated with anticorrosive agents. After being cleaned, all parts inside the pump housing have been sprayed with anticorrosive agents.

The period of protection offered by these conservation measures is approximately 18 months if stored in a dry place. If stored under unfavorable climatic conditions, this protective period may be considerably reduced. Should the anticorrosive layer become damaged, it can be repaired by repainting or respraying.

- Anticorrosive layers inside the pump housing must be removed with process neutral solvents before commencing pump operation.

- When removing the protective coating with a neutral solvent, follow the safety instructions of the solvent manufacturer carefully.

- The anticorrosive layer applied to the exposed parts does not need to be removed before putting the pump into operation.

SECTION FOUR - INSTALLATION

Correct and orderly installation/assembly is necessary for trouble-free operation of the unit. Ruhrpumpen does not assume any liability for damage resulting from inadequate installation/assembly. The chosen location for installation must offer enough space for maintenance activities.

4.1 CONCRETE FOUNDATION PREPARATION

1. Choose a solid ground location for foundation; check that the bearing capacity of the soil is at least one third higher than both static and dynamic loads together.
2. The effects of vibrating equipment on the surrounding area should be investigated and the isolation required for the foundation should be considered. It is important to consider that the driver and the driven machinery must be supported from a common foundation.

- All foundation materials shall be selected to prevent deterioration due to exposure to an aggressive environment; the use of a protective coating should be considered.

- The mass of the concrete foundation should be five (5) to ten (10) times the mass of the supported equipment.

- Imaginary lines extended downward 30 degrees to either side of a vertical line through the pump shaft should pass through the bottom of the foundation and not the sides, as shown in Figure 4.1.

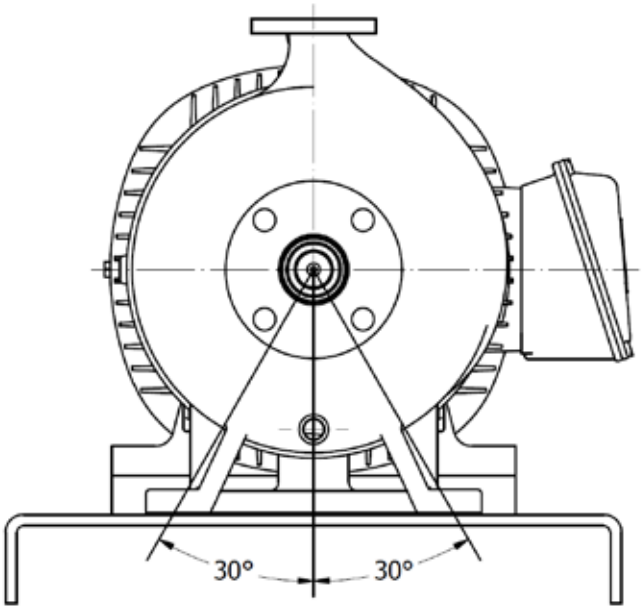


Figure 4.1. Imaginary lines.

3. It is recommended to build foundation approximately 3 inches (76 mm) larger overall than the pump baseplate to provide ample anchorage for the foundation bolts.

   3.1. Since water can accidentally flow in the floor, a height for the surface of the foundation of 4 inches (100 mm) at least above floor level is recommended.

4. Use a template to accurately locate foundation bolts according to the General Arrangement.

   4.1. Choose foundation bolts of size specified in drawing (ASTM A36, M 1020 and ASTM A575 are recommended); they should be long enough to allow a minimum of two threads above the nuts.

5. Provide pipe enclosures for the bolts, which are three or four diameters larger than the bolts.
6. Protect area around the bolts from contact with the concrete.
7. Pour the concrete and provide a chamfer at all corners.
8. Allow concrete to cure completely (at least seven days) before preparing the surface for grout preparation.

4.2 LEVELING BASEPLATE

Before leveling the unit onto the foundation, the following preparations must be made:

1. Chip away all damaged concrete with a hammer and chisel, eliminating about one inch of the surface of the foundation. After surface chipping is done, the foundation shall be thoroughly cleaned free of debris. Clean the anchor holes.
2. Check that the placement and dimensions of the foundation and the anchor holes correspond to the assembly plan.

The foundation must be kept free of all contamination after it has been prepared for grouting.

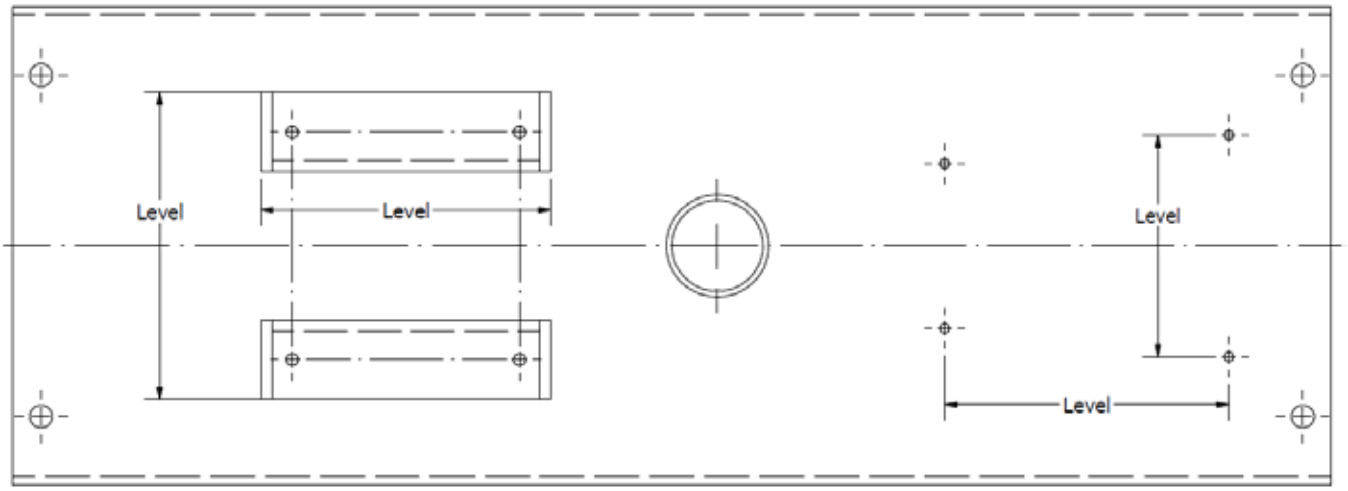
To continue with the leveling procedure:

1. Remove the pump and driver from the base to facilitate the leveling procedure.
2. Place steel blocks and wedges (or shim packs) as closely as possible to the foundation bolts.
3. Remove baseplate from wooden skid.
4. Attach lifting rig hooks to lifting holes of baseplate as described in *SECTION 3.3-TRANSPORT.*
5. Guide baseplate to position above foundation bolts and lower baseplate into position over foundation bolts; be sure to respect the above-mentioned clearance between concrete and baseplate.

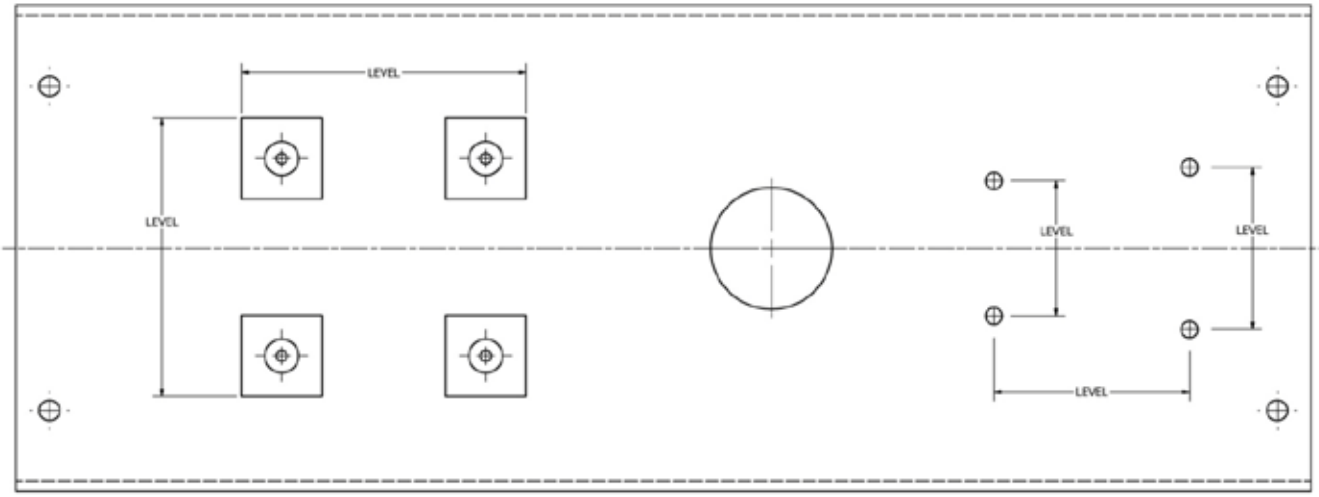
- There should be a minimum annular clearance of 1/8 inch (3 mm) between anchor bolt holes and the anchor bolts to allow for field alignments.

- Exercise proper caution when working under or around suspended objects.

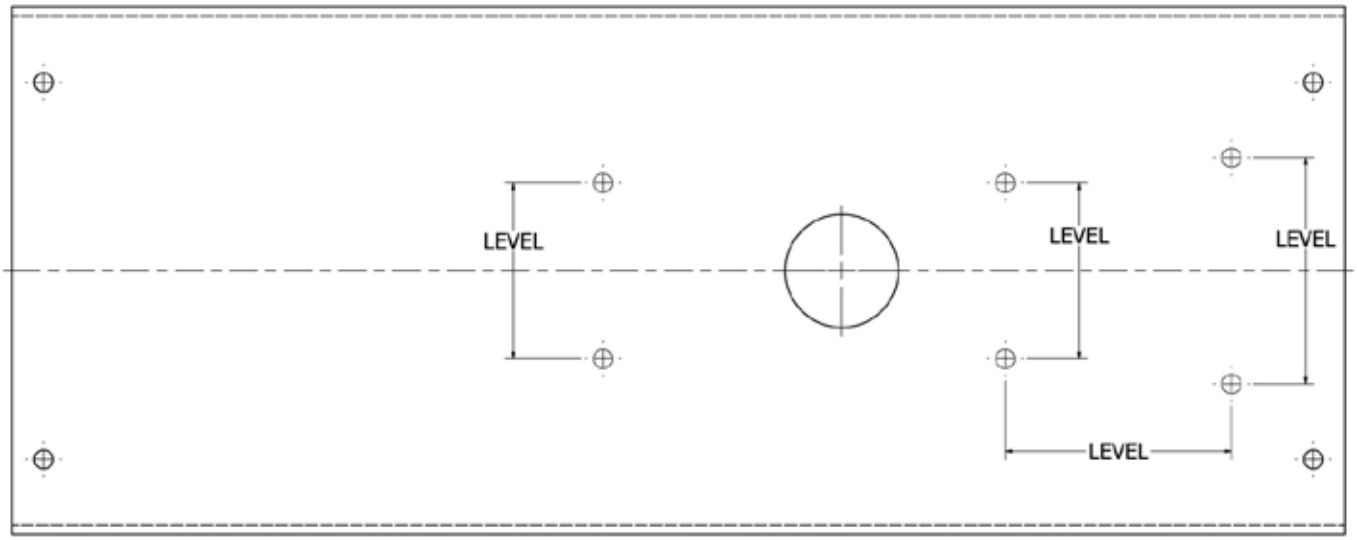
6. Using a precision level across baseplate pads, adjust wedges (shim packs) as necessary to ensure that baseplate is level in all directions (See Figure 4.2); leveling within 0.002 in/ft (0.2 mm/m) is recommended. Wedges or shim packs should feel solid when tapped lightly by a hammer.



CPP21 and CPP-L with pedestals



CPP21 and CPP-L with mounting blocks



CPP C-Frame

Figure 4.2. Baseplate leveling planes.

· NOTE: The baseplate should be mounted without distortion.

7. When baseplate is level, 'snug' the foundation bolt nuts, but do not tighten completely.

4.3 GROUTING

4.3.1 Equipment/Material Required

· Grout Mix: Non Shrink Type

· Sufficient lumber for foundation template and grout trough.

· Risers or funnels for guiding grout.

· Sufficient oil paint for grout protective covering.

4.3.2 Grouting Precautions

During all the grouting process, the involved personnel must follow these safety precautions:

1. Wear goggles or face shields, aprons, and protective gloves at all times.
2. Wear dust masks if in contact with the dry aggregates.
3. Wash hands regularly with soap and water.

· Some epoxy grouts have highly exothermic reactive properties; they should be handled with care. They may become extremely hot and cause severe burns.

4.3.3 Grouting Procedure

1. Verify that anchored bolt sleeves are clean and dry. Fill them with a nonbonding moldable material to prevent them from being grouted.
2. The anchor bolt threads should be protected with tape before grouting.
3. Provide a form around the baseplate to contain the grout. The form should be chamfered at all corners.

· Grout forms should be attached with drilled anchors. Do not power nail.

- Apply three coats of paste wax to the inside surfaces of the forms in order to prevent adherence. Do not use oil or liquid wax.

- Prevent grout leakage, as leaks will not self-seal.

Apply the grout, starting at one end of the form and advancing toward the other end. The use of push tools to get rid of trapped air is allowed if done in long strokes.

- Do not vibrate or violently ram the grout (it may cause the aggregates to separate).

- Do not plug any baseplate fill or vent holes until the grout has set to avoid baseplate distortion.

- Check with the supplier of the grout the preferred thickness for your installation.

4. Tap baseplate to eliminate air pockets.

- It is imperative to get rid of all trapped air before the grout hardens.

- Check frequently for grout leaks.

- Leaks will not self-seal and may cause voids.

5. Once the grout has completely hardened (takes around 3 days), remove wedges (shim packs) and grout-forms. Fill the holes with grout.
6. Tighten the foundation bolts with an appropriate torque value. In case of doubt, please contact your Ruhrpumpen representative.
7. Apply oil paint to exposed grout to protect from air and moisture.
8. Use a lifting rig to position the pump and driver on their baseplate so that the mounting feet line up with their respective tapped holes.

9. Fasten the pump and driver hold down bolts, attach all auxiliary piping and wiring.

SECTION FIVE - PIPING AND ALIGNMENT

- These units are furnished for a specific service condition. Any change in the hydraulic system may affect the pump performance adversely.

- The connection of the piping must be carried out with utmost care; otherwise, the pumping medium can escape during operation, which can seriously endanger the operating personnel.

- Do not start the piping and alignment procedures until grouting, preliminary alignment (as seen in the previous sections of this manual) and on site welding have been performed.

- In a new installation, great care should be taken to prevent dirt, scale, welding beads, and other items from entering the pump. The suction system should be thoroughly flushed before installing the suction strainer and suction piping.

- Suction and discharge piping should be of ample size, be installed in direct runs with minimum bends.

- Short-radius elbows shall be avoided near the suction nozzle. If an elbow is necessary, it should be of the long radius type.

- Suction and discharge piping configurations should be in accordance with the Hydraulic Institute Standards.

- Suction and discharge piping, fittings, and valves must be adequately supported and anchored close to the pump flanges to eliminate strains imposed on the pump case, prevent excessive nozzle loads, maintain pump/driver alignment, and avoid pipe-induced vibration.

5.1 PIPING THE SYSTEM

1. Check whether the piping is loosely laid, so that no strain is placed on the pump.

· Piping layout and installation shall provide adequate maintenance and operation accessibility. Field installed auxiliary equipment shall not interfere with removal of the machine or driver.

2. Remove the covers of the pump flanges.
3. Check whether the seals are correctly mounted.
4. Install a check valve and a gate valve in the discharge pipe. When the pump is stopped, the check valve will protect the pump against excessive back-flow pressure and will prevent the pump from running backward.

· The check valve should be installed between the gate valve and discharge flange in order to permit its inspection.

5. A spool piece should be installed in suction line so that the suction strainer may be installed and removed with a pressure gauge between the strainer and pump.
6. The suction strainer should be installed between 5 to 20 pipe diameters upstream from the suction flange.
7. Cone type strainers (otherwise known as “witches – hat” strainers) should be mounted as recommended by the Hydraulic Institute, with the cone pointing upstream away from the pump, into the oncoming flow. As the strainer gradually gathers particles from the liquid and blocks up, this direction will result in the lowest turbulence impact onto the liquid flow entering the pump.

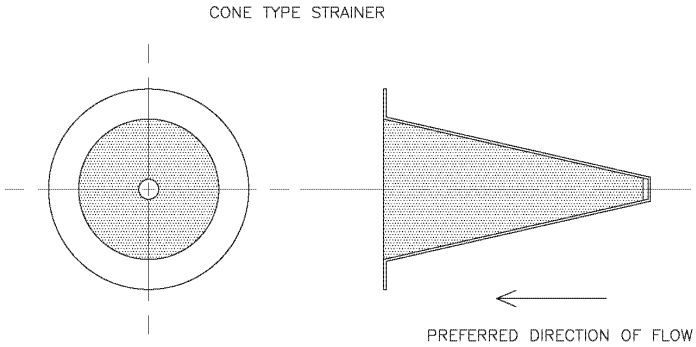


Figure 5.1. Correct mounting of a cone type strainer.

8. Disconnect the piping from the pump if you heat one side of the pipe to align the pipe to the pump.
9. Pump and pipe flanges must be parallel; they should mate together without effort, and with the bolt holes properly in line.
10. Check the fine alignment by clocking or using a Dial Type Indicator (DTI) on the coupling. Check the operating instruction for the coupling.

11. Connect and tighten the suction pipe and compare the alignment with the values of the fine alignment. In the case of deviations, warm the pipe so that the values of the fine alignment are reached.

- When heating takes place close to the flange, there is a danger that the flange seal will become rippled and leaky. No more welding work can be carried out on the piping when it is screwed to the pump.

12. Proceed in the same way with the discharge pipe.

- Make sure that there are isolation block valves at the pump for each type of auxiliary piping.

- Consider a slope in the suction piping to avoid high points.

- In horizontal suction lines, reducers should be eccentric (with the flat side of the reducer on top).

- No obstruction within at least five pipe diameters of the suction flange should be fitted.

- Do not install unsupported piping on the pump.

- Make sure electrical connections do not impose any stress on the pump unit.

- Remember that the pump must not be moved once the baseplate has been set: the piping (both suction and discharge) is the one aligned to the pump.

- When aligning, all the elements to be aligned (including the pipes) should be at the same temperature (ambient).

- It is important to confirm that the pump can be moved out from the baseplate without cutting or welding (only by adjusting connections and flanges).

- Do not use drifts or cheater bars to force alignment of bolt holes – serious damage to the pump will result.

5.2 ALIGNMENT* [1]

In the following pages, alignment procedures are explained with dial indicators. Laser alignment is also possible. The specific method in laser alignment will depend on the manufacturer's instructions; however, the basic principles and rotation of the shafts apply, as in the Reverse Indicator Alignment Method. Therefore, for laser alignment, you may follow the steps detailed on the next pages, mounting a laser bracket with a measurement device on each shaft and then proceed with the rotation of the shafts to obtain the readings to determine the misalignment and correct it.

A. ALIGNMENT OF EQUIPMENT

Correct alignment is mandatory for the successful operation of rotating equipment. A flexible coupling is no excuse for misalignment. The relationship between shaft centerlines can easily be determined by 1) two step dial indicator method, 2) reverse indicator alignment, 3) across the disc pack alignment. These can all be solved by a graphical approach. This procedure will discuss methods 2 and 3. Method 1 is covered in Rexnord's Manual MT-SS-04-001, "Two Step Dial Indicator Method". Before we get into this alignment procedure, several items should be considered at this point.

1. Indicator Set-Up

No matter what arrangement you use, indicator sag must be determined. This can easily be determined by clamping the set-up onto a rigid piece of pipe, rolling the indicator from top to bottom, and reading the difference. Once the indicator sag set-up has been determined, this number can be algebraically subtracted from the alignment readings obtain at the bottom. There is no need to be concerned about the side to side readings as the sag is equal on both sides.

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[1] *This section does not apply to pumps with C-Frame, since these pumps are self-aligned.*

2. Taking Alignment Readings

It is suggested that the dial indicator be zeroed at the top. For convenience, you should mark your coupling at 0°, 90°, 180°, and 270° with a reference mark on the case so that you can be sure to turn the unit exactly 90°. Both shafts should be turned an equal amount if the coupling is not put together. Now rotate the coupling in 90° increments recording all readings. It is important to keep your side to side readings straight. A suggestion is to show compass orientation so that you know which reading to use. After you have made your four position check and have returned back to the top, it is absolutely necessary that the indicator return to zero where it started. If it did not, repeat your readings. It is also advisable to check the readings several times to make sure that they are repeatable.

3. Thermal Growth

If there are thermal growth considerations on the piece of equipment, it is a good idea to get these numbers so that they can be added to or subtracted from the graphical solution before the equipment move is made, this is known as “Hot alignment”.

4. Soft Foot

The fact that your equipment could have a soft foot can affect the alignment readings that you obtain. The soft foot should be checked first and eliminated. This can easily be done by mounting a dial indicator on the base plate indicating off the top of foot on the machine to be checked. Each foot in rotation is then checked by loosening only the bolt with the rest of the bolts being tight. A soft foot check should be carried out when the unit is stationary for safety reasons, and should be carried out on whole drive train. It should never be necessary to shim under the pump mounting feet. Soft foot issues could indicate excessive piping loads transmitted to the pump, or that the baseplate has been twisted, and is not grouted and mounted flat.

B. REVERSE INDICATOR ALIGNMENT GRAPHICAL ANALYSIS

On a sheet of graph paper, lay out the equipment that you are trying to align. You should use a scale that is convenient to the size of the graph paper. The distances that are critical are:

1. Distance from where the first indicator rides on the pump hub to where the second indicator rides on the motor hub. In the example shown below, this is 10-1/2 inches (266.7 mm).
2. Distance from where the second indicator rides on the motor hub to the center of the front motor feet. In the example below, this is 2-1/2 inches (63.5 mm).
3. Distance from the center of the motor front feet to the center of the motor back feet. In the example shown below, this is 5-1/4 inches (133.4 mm).

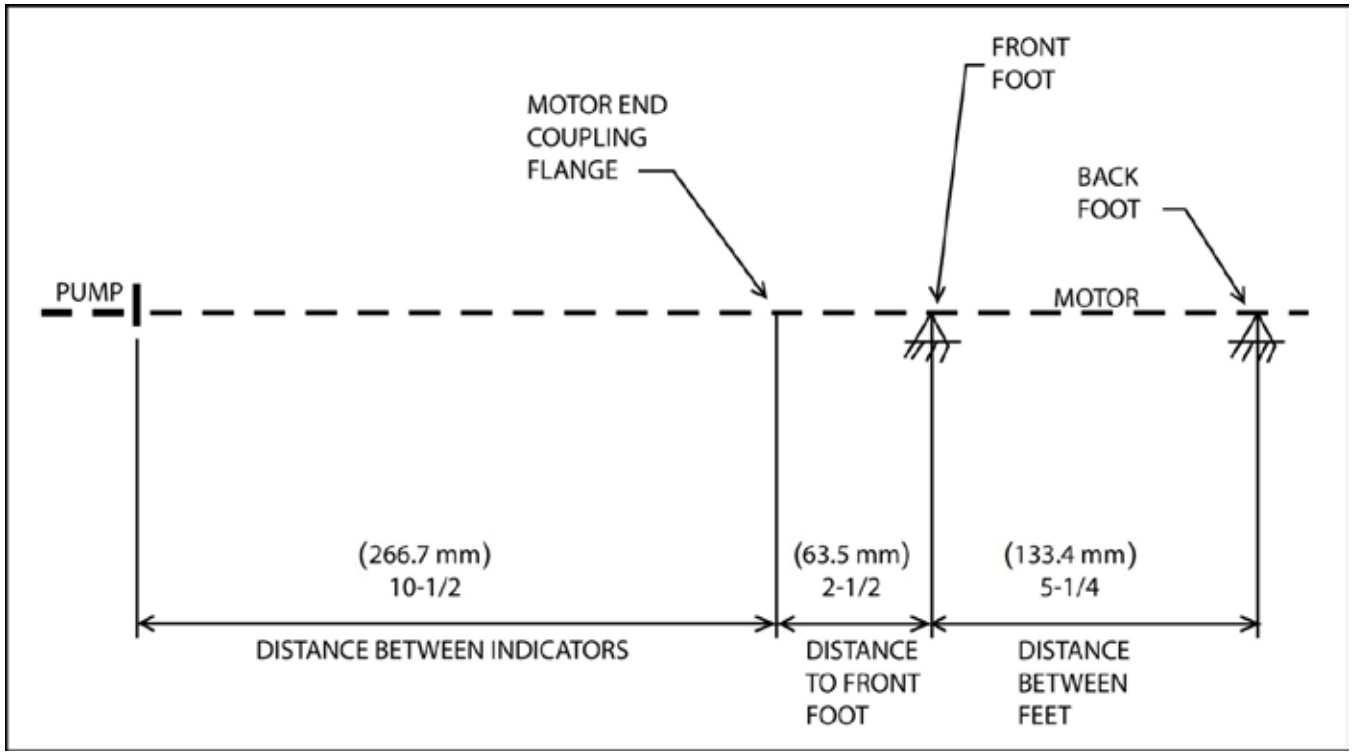


Figure 5.2. Example for reverse indicator graphical analysis.

The next step is to determine indicator sag. Set up your bracket arrangement on a pipe. Set the indicator at '0' on top. Roll set up until indicator is at the bottom of pipe. It will read negative. In this example, it is found to be -0.005 inch (-0.127 mm).

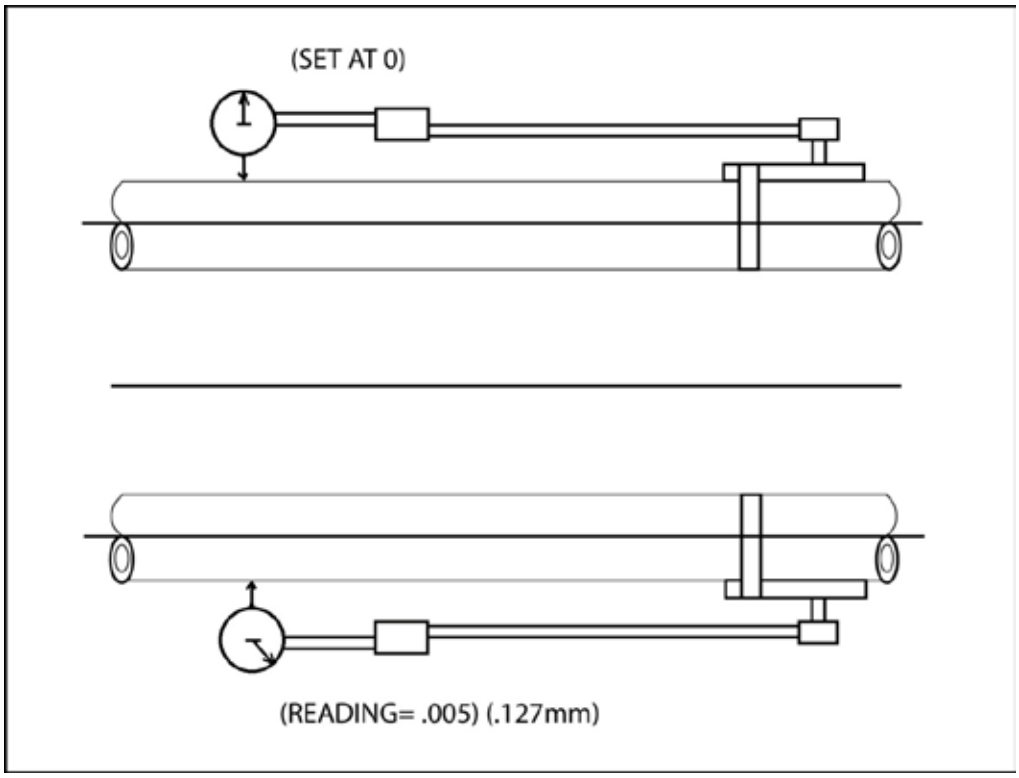


Figure 5.3. Indicator sag.

With the indicator bracket attached to the motor hub reading off the pump hub, rotate unit in 90° increments and take readings.

Bottom reading is then corrected for indicator sag. Indicator sag in the example was determined to be 0.005 inch (0.127 mm). The -0.005 inch (-0.127 mm) was subtracted from the -0.025 inch (-0.639 mm) indicator reading to give an actual -0.020 inch (-0.508 mm) reading.

As this is a TIR (Total Indicator Readout) it is two times the actual shaft to shaft rotation 0.020 inch (0.508 mm)/ 2 inch (50.8 mm) or 0.010 inch (0.254 mm) is used to show where the motor shaft extension is relative to the pump shaft center line at the hub. Minus at the bottom indicated motor shaft extension is low compared to the pump. Using a scale of one small division on the graph equals 0.001 inch (0.0254 mm); plot this point as show in the example.

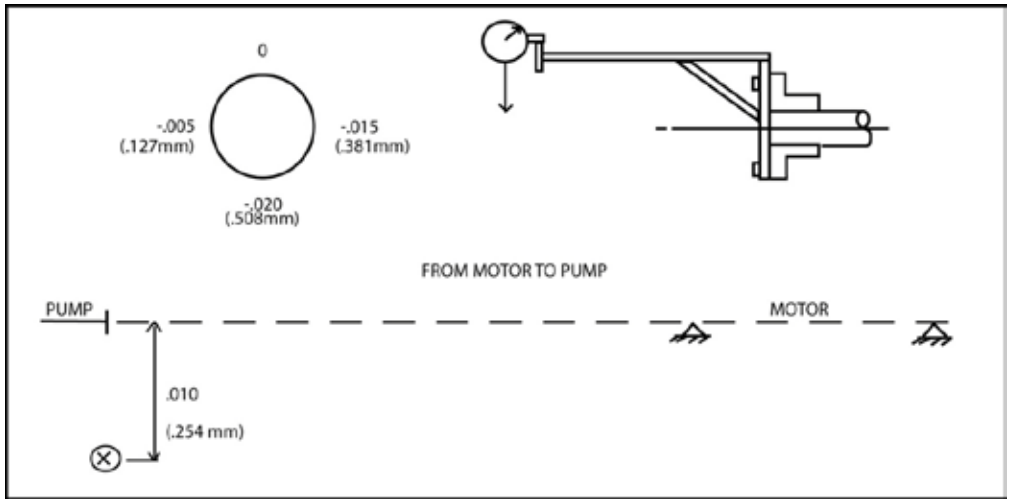


Figure 5.4. Motor shaft extension relative to the pump shaft center line.

Now with the indicator bracket attached to the pump hub reading off the motor hub, rotate unit again in 90° increments. NOTE: If you can set up both indicators at once, both sets of readings can be taken at one time.

Bottom reading is then corrected for indicator sag. The -0.005 inch (-0.127 mm) was subtracted from the +0.005 inch (+0.127 mm) indicator reading to give an actual +0.010 inch (+0.254 mm) reading.

The +0.010 inch (+0.254 mm) is divided by two to give +0.005 inch (+0.127 mm) which is the actual shaft extension to shaft relationship.

In this case, a plus reading at the bottom indicates the motor shaft is low compared to the pump shaft extension. Plot this point as shown in the example.

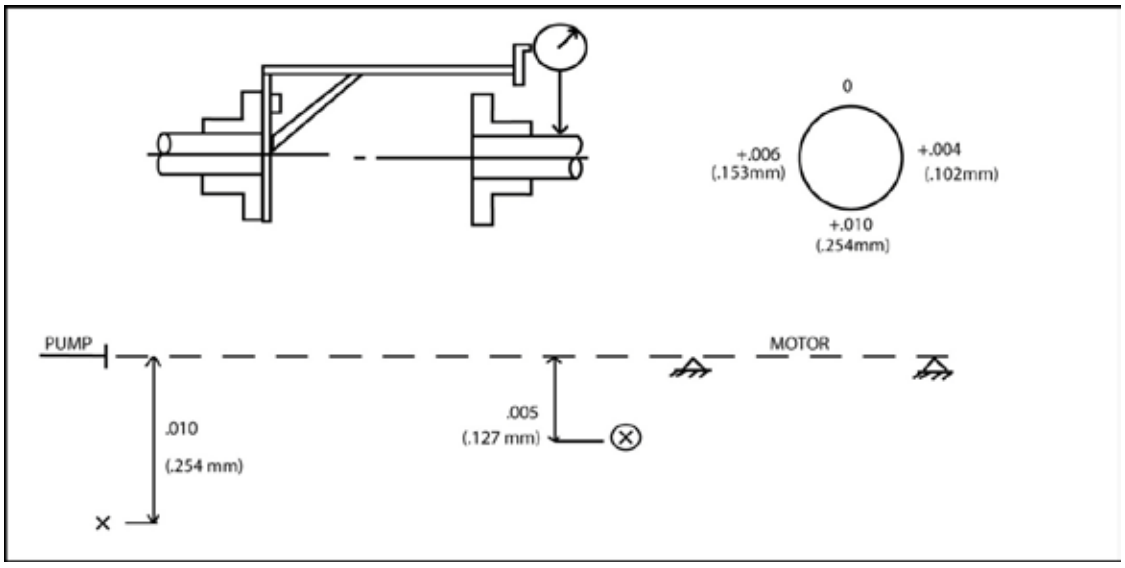


Figure 5.5. T.I.R. second reading.

We have now located the motor shaft theoretical extension in two places:

A. In the plane of the pump hub.

B. In the plane of the motor hub.

Drawing a straight line through these two points crossing the plane of the two motor feet. The shim adjustment can now be read directly off the graph. In this example, 0.004 inch (0.102 mm) should be added to the front foot and 0.001 inch (0.025 mm) should be added to the back foot.

This solution can also be done by the use of pre-programmed, hand calculators for faster results.

For the horizontal (side to side) results, the same procedure is used. Algebraically subtract the side to side readings. Indicator sag can be ignored as it cancels out. Plot these readings and the results can be read off the graph plot.

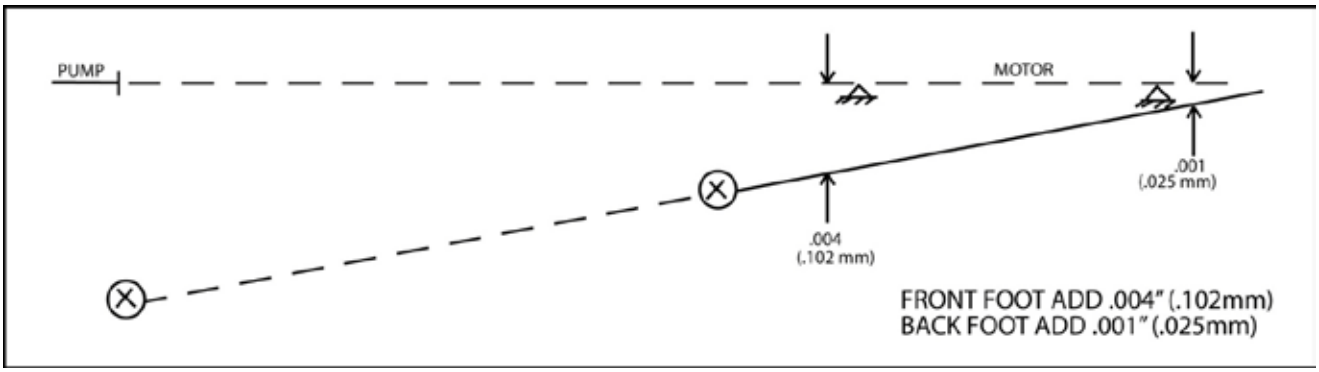


Figure 5.6. Final graph plot for reverse indicator alignment graphical analysis.

C. REVERSE INDICATOR ALIGNMENT MORE THAN TWO UNITS GRAPHICAL ANALYSIS

This method lends itself very well in solving alignment problems of three or more pieces of equipment in a line.

To solve this problem, follow the steps already outlined for each coupling in the train. Plot the shaft to shaft relationship of each set of shafts. Look at the total picture. In this example, a line was drawn through the average of all points plotted. The units were then aligned to this mean line.

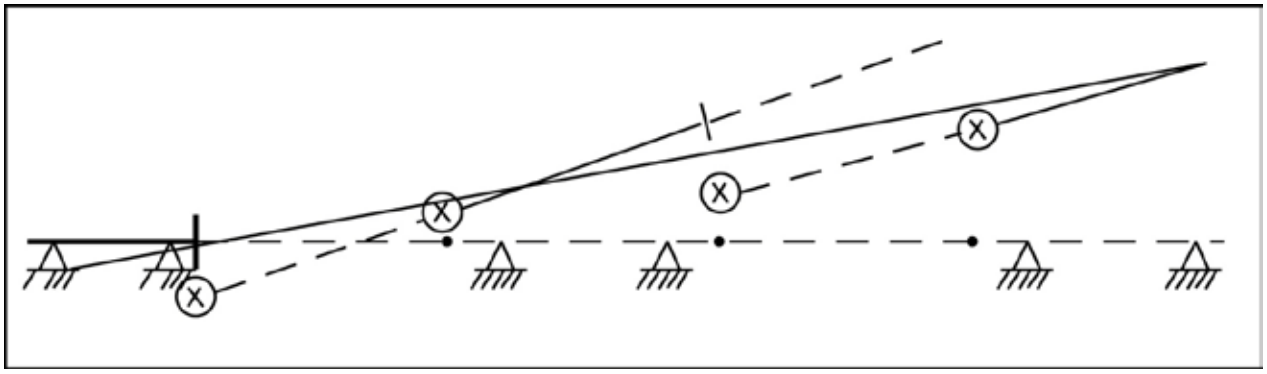


Figure 5.7. Reverse indicator alignment of more than two units.

D. ACROSS THE DISC PACK ALIGNMENT GRAPHICAL ANALYSIS

When the distance between disc packs is long where it is not practical to try to span the distance with indicator bracketry, the 'across the disc pack method' can be used.

On a sheet of graph paper, lay out the equipment that you are trying to align. You should use a scale that is convenient to the size of the graph paper. The distances that are critical are:

1. Distance from centerline of one disc pack to the centerline of the other disc pack. In the example, it is 9-1/2 inches (241.3 mm).
2. Distance from centerline of motor disc pack to center of front motor foot. In this example, it is 3 inches (76.2 mm).
3. Distance from the center of the motor front feet to the center of the motor back feet. In this example, it is 5-1/4 inches (133.4 mm).
4. Distance from disc pack to dial indicator on center member. In this example, the distance is 8 inches (203.2 mm).

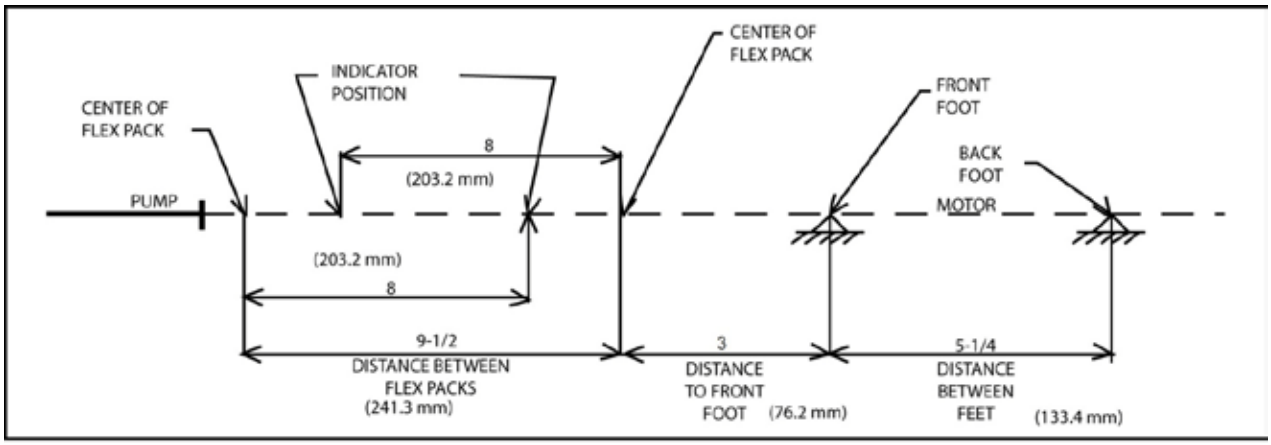


Figure 5.8. Across the disc pack alignment graphical analysis example.

The next step is to determine indicator sag. Set up your bracket arrangement on a pipe. Set the indicator at '0' on top. Roll set up until indicator is at the bottom of pipe. It will read negative. In this example, it was found to be -0.004 inch (-0.102 mm).

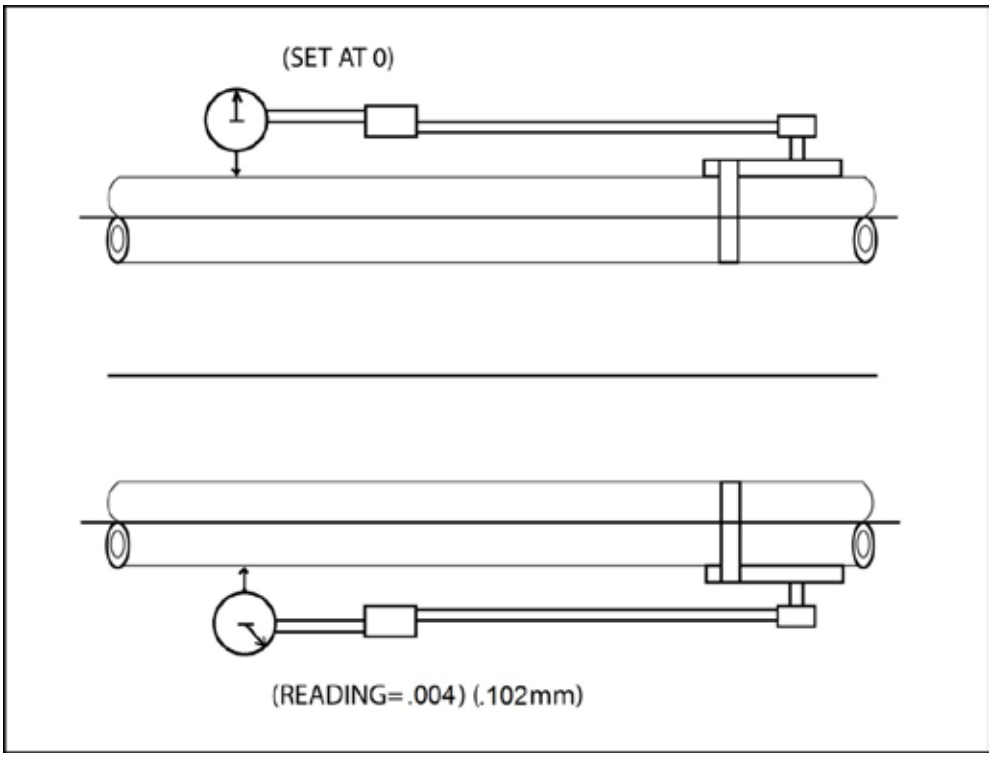


Figure 5.9. Indicator sag in across the disc pack alignment analysis example.

With the indicator bracket attached to the pump hub, reading out the center member a convenient distance, (in this example 8 inches [203.2 mm] was used) rotate the unit in 90° increments and take readings.

Bottom reading is then corrected for indicator sag. The indicator sag in the example was determined to be -0.004 inch (-0.102 mm). The -0.004 inch (-0.102 mm) was subtracted from -0.025 inch (-0.635 mm) indicator reading to give an actual of -0.020 inch (-0.508 mm) reading.

As this is a TIR (Total Indicator Reading) it is two times the actual center member center line location relative to the pump shaft extension or -0.020 inch (-0.508 mm) / 2 inches (50.8 mm) = -0.010 inch (0.254 mm). (What we are trying to do here is to determine the angle the center member makes with respect to the pump shaft.)

A plus reading at the bottom indicates that the center member tips down as it extends away from the pump. Using a scale of one small division on the graph equals 0.001 inch (0.0254 mm); plot the 0.010 inch (0.254 mm) as shown in the example.

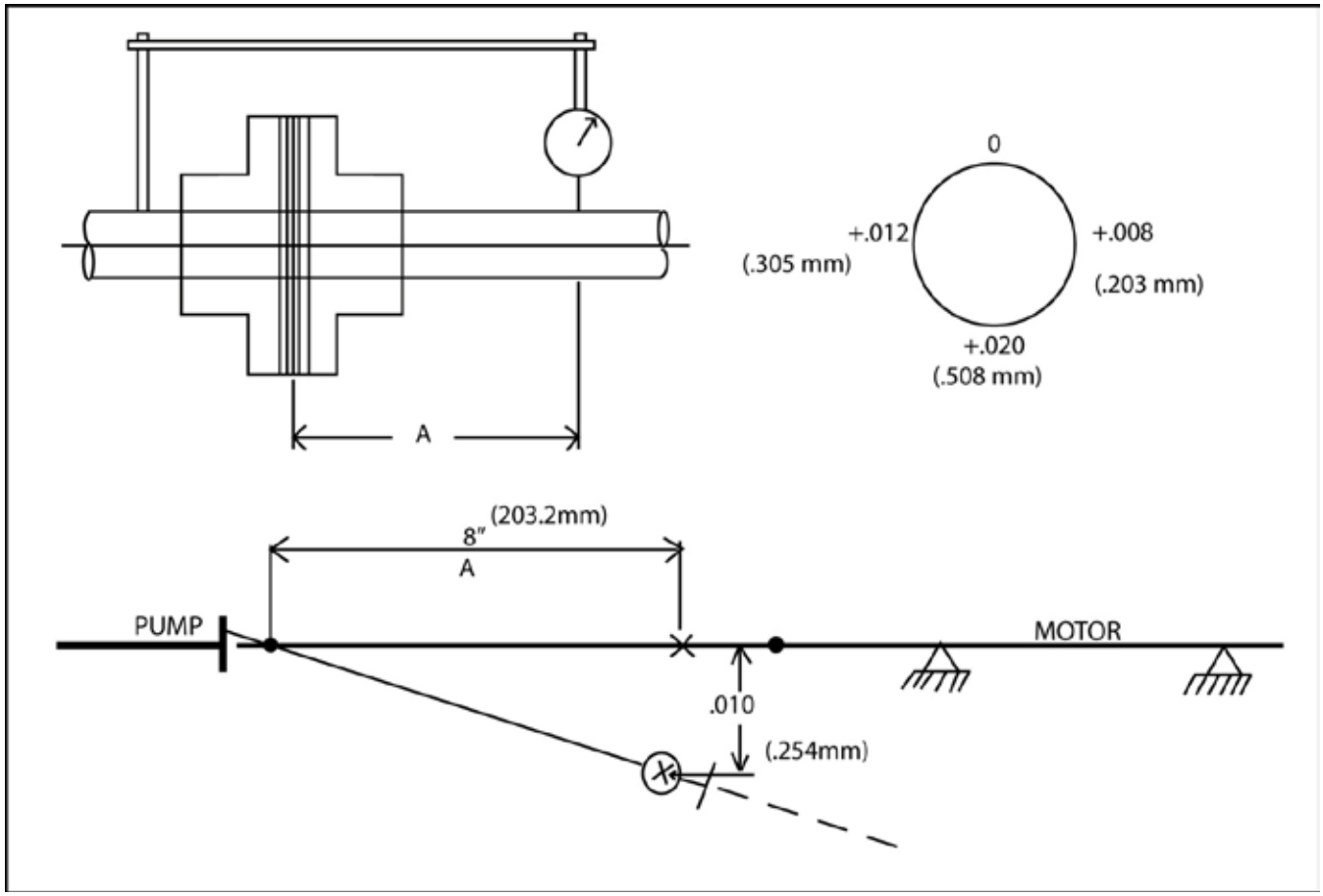


Figure 5.10. Plot of the plus reading in the across the disc pack alignment analysis example.

Now with the indicator bracket attached to the motor hub reading out on the center member, rotate the unit in 90° increments and take readings.

Bottom reading is corrected for indicator sag: ±0.008 inch (±0.203 mm) -0.004 inch (0.102 mm) = +0.012 inch (+0.309 mm). This is TIR so actual is +0.006 inch (+0.152 mm). (What we are trying to do here is determine the angle the center member makes with respect to the motor shaft.)

The minus reading on the bottom indicates that the center member tips up as it extends away from the motor. Using a scale of one small division on the graph equals 0.001 inch (0.025 mm), plot the 0.006 inch (0.192 mm) as shown on the example.

The motor shaft can now be drawn in because two points along it have been defined: 1. Center of the flex element. 2. The point just plotted 0.006 inch (0.152 mm) below center member. The shimming requirements can now be read off the plot where the motor shaft intersects the planes of the motor feet.

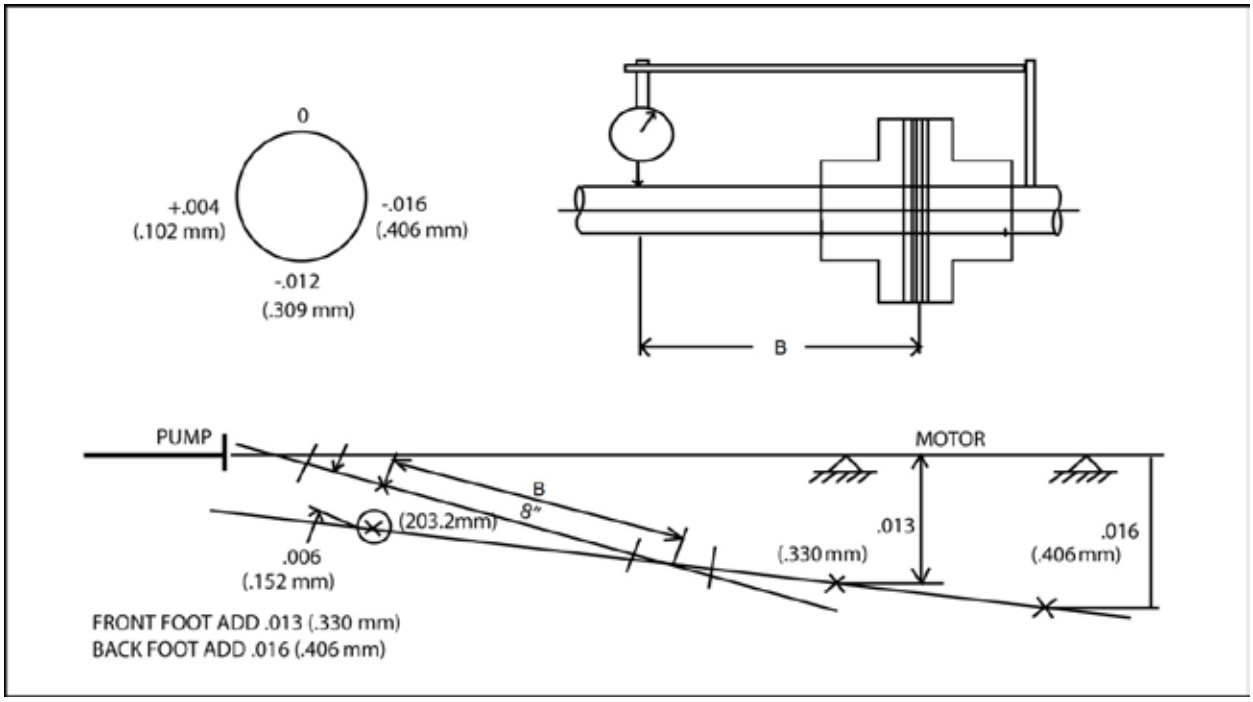


Figure 5.11. Plotting the motor in the across the disc pack alignment analysis example.

In this example, the motor should be shimmed up 0.013 inch (0.330 mm) under front feet and shimmed up 0.016 inch (0.406 mm) under back feet.

This solution can also be done by use of a pre-programmed, calculator for faster results.

For the horizontal (side to side) results, the same procedure is used. Algebraically subtract the side to side readings. Indicator sag can be ignored as it cancels out. Plot these readings and the results can be read off the graph.

5.3 MOUNTING BLOCKS OR PEDESTALS

The driver may be fastened to the baseplate by either pedestals or a block mounting system.

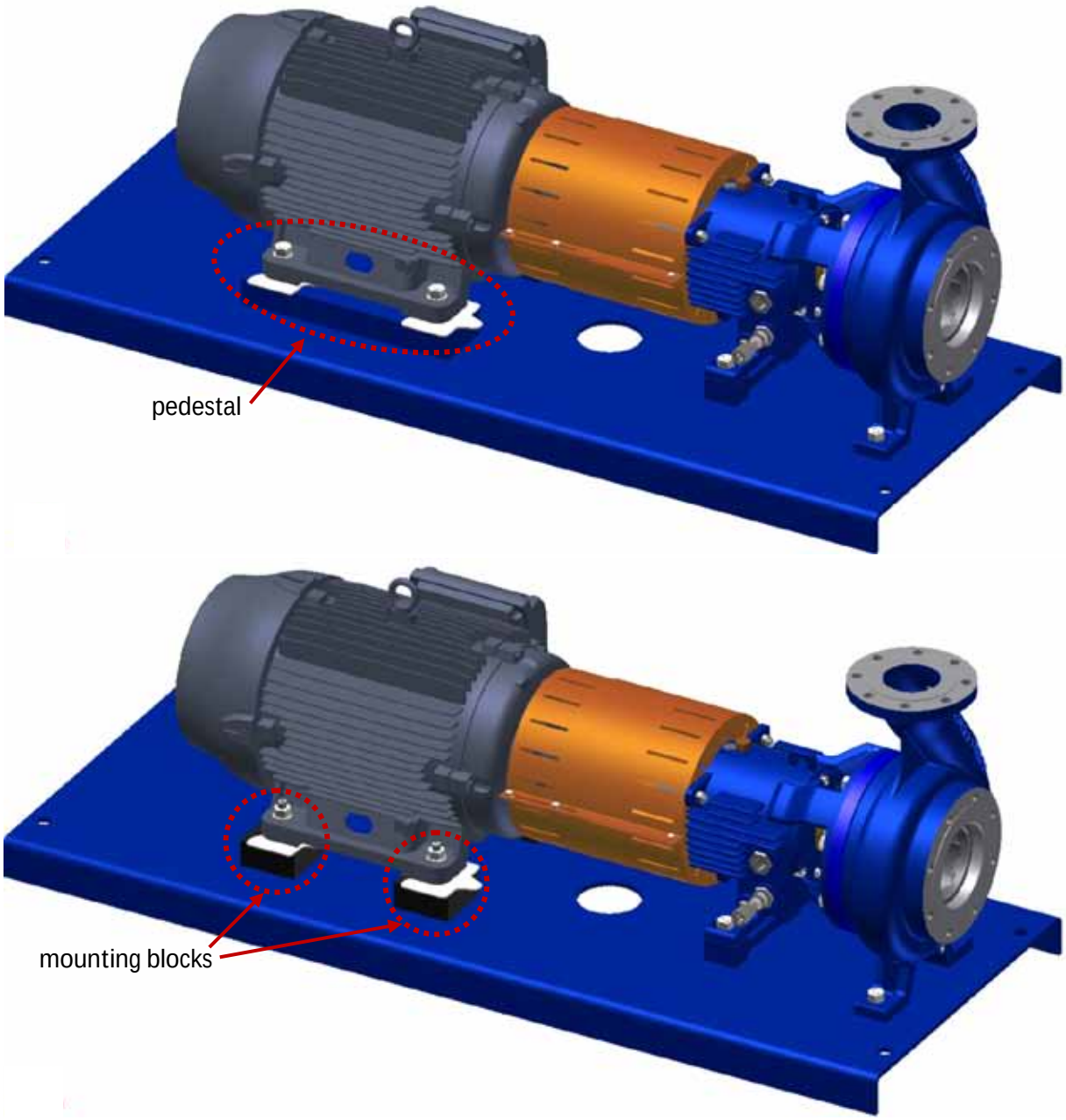


Figure 5.12. Above, baseplate with pedestals for driver. Below, baseplate with mounting blocks for driver.

Regardless of the method to support the driver, the alignment procedure is the same.

When the baseplate has pedestals for the driver, each foot is secured to the baseplate with a hexagonal head screw.

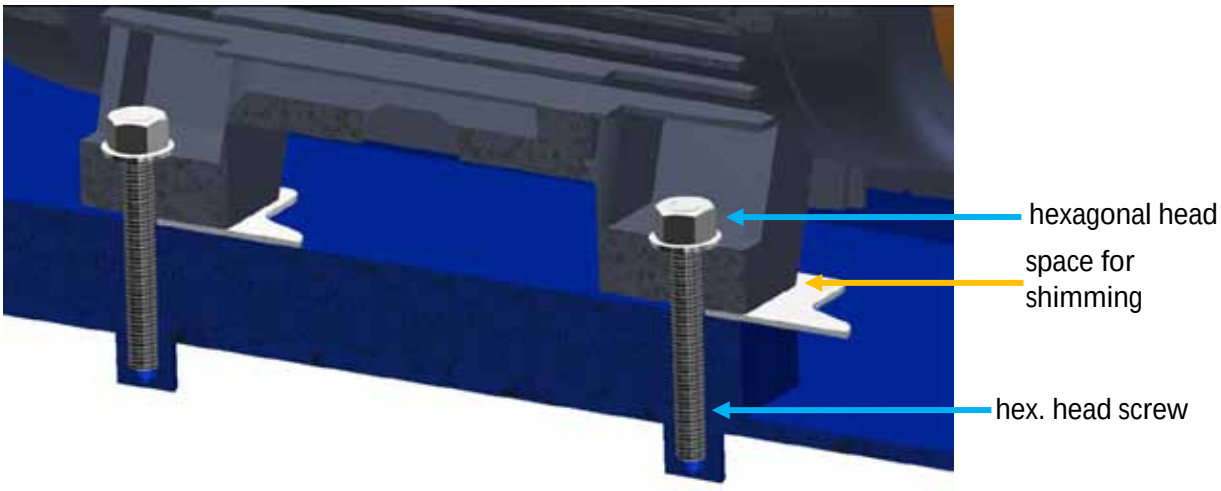


Figure 5.13. Detail of pedestal system to secure the driver's feet.

The mounting blocks system consists of a mounting stud, with an intermediate nut to secure the mounting block to the baseplate, and an upper nut to fasten the driver's foot to the mounting block.

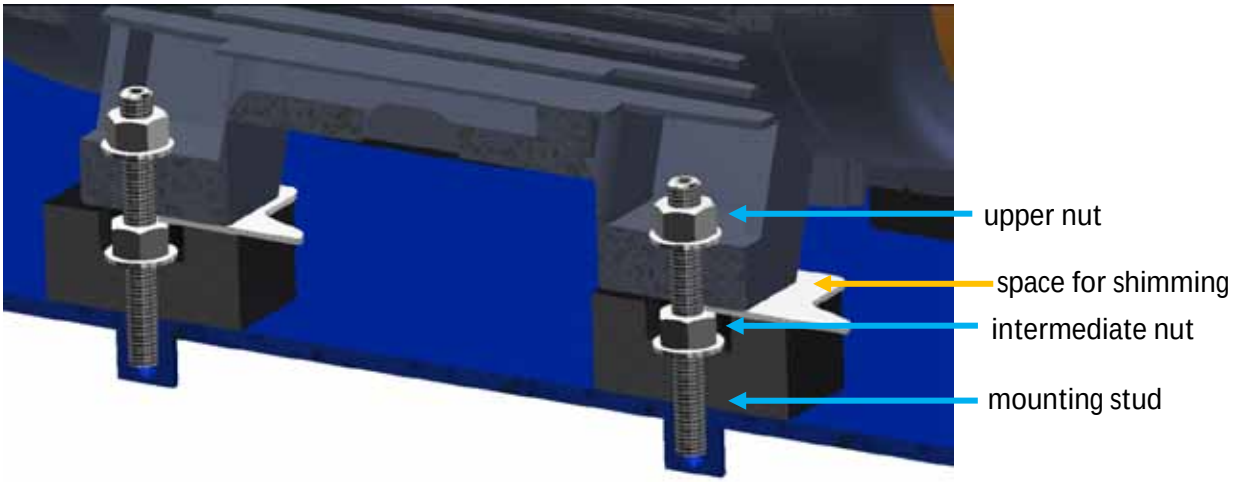


Figure 5.14. Detail of mounting block system to secure each driver's foot.

According to the alignment procedure detailed in *SECTION 5.2-ALIGNMENT*, the driver is aligned, if required, with shims below the driver's feet.

SECTION SIX - LUBRICATION

6.1 OIL LUBRICATION

6.1.1 Recommended Lubricant

The recommended bearing frame oil is ISO VG 68 non-detergent oil. Turbine quality oil is preferred. This oil may be used during break-in and normal operation.

6.1.2. Method of Application

Customer must fill bearing frame before startup. The bearing frame is supplied with a sight glass. Fill the bearing frame with oil until the middle of the oil sight, according to the quantities specified in the next section.

Pour oil into the bearing frame through the breather connection located at the top of the bearing frame, leaving an amount equal to the capacity of constant level oiler bottle apart (only if pump has optional oiler). The correct level is observed in the middle of the oil sight glass.

- Oil level should be determined by using sight glass in bearing frame. Oil level in optional constant level oiler does not correspond to oil level in bearing frame.

- Ruhrpumpen takes every precaution during our assembly process and subsequent final assembly audits to ensure no bearing frame oil leaks exist prior to shipment. Oil can leak past the labyrinth seal in an “overfill” condition. Refer to the filling instructions for additional information.

6.1.3 Quantity

Frame	Oil quantity	
	Quarts	L
10	0.21	0.20
30A	0.79	0.75
30B	1.80	1.70
50	3.17	3.00

Always verify and replenish the oil if the level falls below the middle of the oil sight glass.

6.1.4 Optional Cooling Coil

If the pump has been ordered with the optional cooling coil, the pump has a cooling coil in the bearing frame, with inlet and outlet connections for the coolant. A schematic drawing of this cooling system is shown on the next figure:

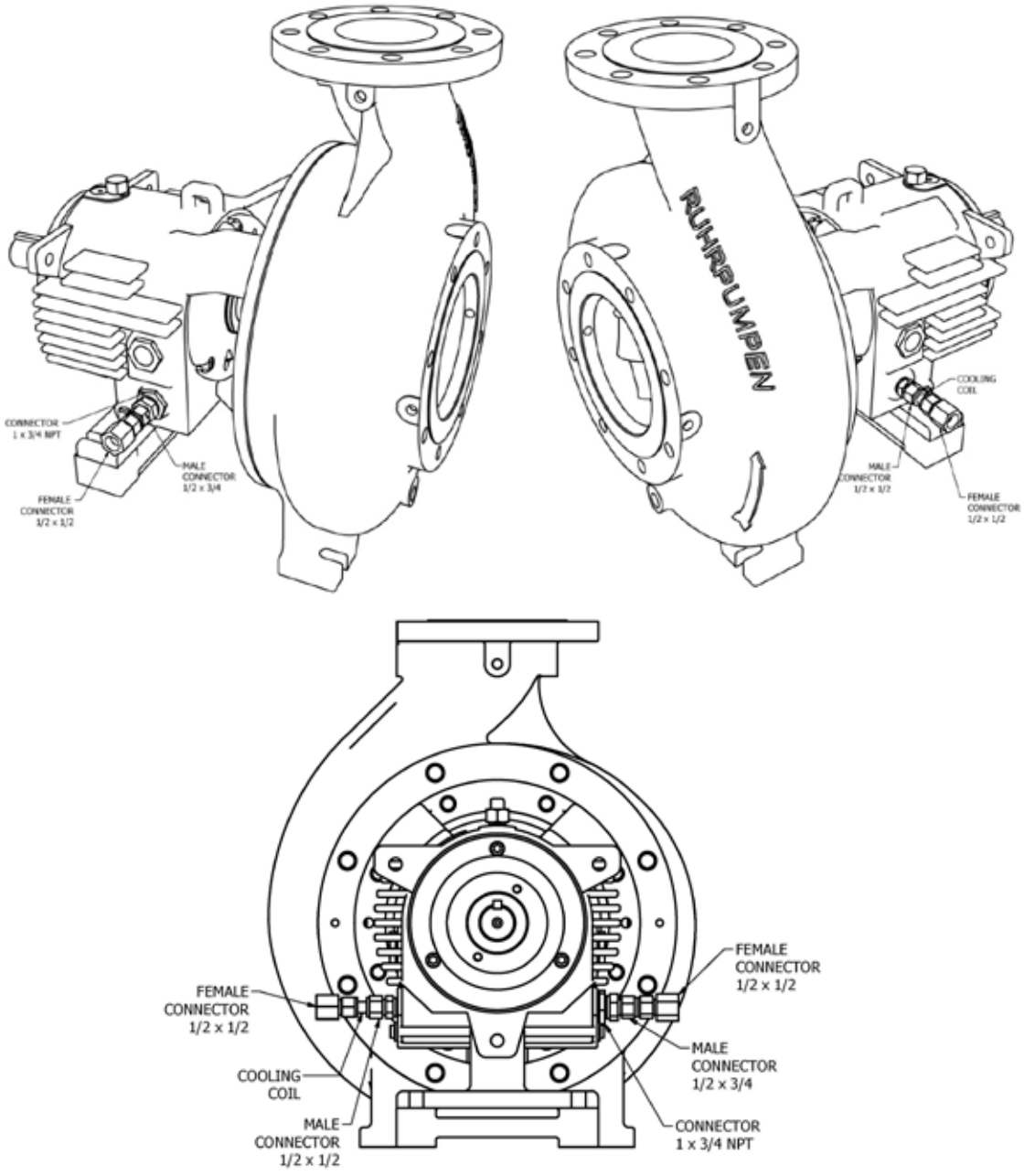


Figure 6.1. Cooling coil option.

The piping connections are female connectors of ½ inch for both ends.

The cooling coil option is available only when the bearings are lubricated with the standard oil lubrication (*SECTION 6.1-OIL LUBRICATION*) or the optional purge oil mist lubrication (*6.3 PURGE OIL MIST-WET SUMP*).

6.1.5 Maintenance

Once every eight hours of pump operation, perform visual inspection of oil and oil level.

Oil in bearing frame should be changed every six months.

1. Drain bearing frame through drain location identified on General Arrangement.
2. Flush bearing frame with clean lightweight oil.
3. Reinstall drain plug and refill bearing frame.

- If it is suspected that bearings have been exposed to dirt or moisture, thoroughly clean the bearings and frame with a solvent and air-dry the parts before adding lubricant. Disassembly, inspection, cleaning, and reassembly procedures are provided in *SECTION EIGHT - MAINTENANCE*.

6.2 PURE OIL MIST-DRY SUMP

- When pure oil lubrication is supplied, the oil mist is the only lubricant provided.

- The oil mist generator must be running before starting the unit.

Basic oil-mist generating system should include the following:

1. An airline filter water separator to assure a clean air supply to oil-mist generator.
2. An air pressure regulator to control the oil-mist generator atomizing air pressure.
3. An oil-mist generator which includes a venturi nozzle, oil lift tube, reservoir and oil flow adjustment screw.
4. Mist distribution manifold to convey the oil-mist application fittings.
5. Spray application fitting to meter and convert the oil-mist at each lubrication point.

- Recommended Oil: ISO VG 68 Non-Detergent Oil suitable for oil misting. (Refer to instructions with Oil Mist Generator.)
- Air/Oil Ratio should be 0.40 cubic inches/hour/cfm (231.5 cc/hr/m^3/min)
- Type of Oil Mist Fitting: Spray type

Provide oil mist through the oil mist inlet as indicated on the General Arrangement.

Oil mist should be vented out thru the vent as indicated on the General Arrangement. (When pump is idle and mist generator is on, a mist should be visible exiting the vents. When pump is running, the windage associated with the shaft, bearing, and coupling makes it difficult to see the mist.)

Maintenance:

- Periodically inspect the sediment bottle underneath the bearing frame. (Drain as required.)
- If bearing frame is dismantled, flush bearing frame with clean lightweight oil (e.g. ATF).
- Be certain bearings have a light coating of oil before startup.

6.3 PURGE OIL MIST-WET SUMP

- When purge oil lubrication is supplied, the oil mist is used to maintain a positive pressure in the bearing housing to keep contaminants from entering the bearing housing.

All the steps outlined in *SECTION 6.1-OIL LUBRICATION* apply, along with the following additional items.

Basic Oil-Mist generating system should include the following:

1. An airline filter-water separator to assure a clean air supply to oil-mist generator.
2. An air pressure regulator to control the oil-mist generator atomizing air pressure.
3. An oil-mist generator which includes a venturi nozzle, oil lift tube, reservoir and oil flow adjustment screw.
4. Mist distribution manifold to convey the oil-mist application fittings.
5. Spray application fitting to meter and convert the oil-mist at each lubrication point.

Provide oil mist through the oil mist inlet as indicated on the General Arrangement. Oil mist can be vented out thru the vent as indicated on the General Arrangement; however, if the intent is to maintain positive pressure in the bearing housing then no venting is needed.

- Recommended Oil: ISO VG 68 non-detergent oil suitable for oil misting. (Refer to instructions with oil mist generator.)
- Air/Oil Ratio should be 0.40 cubic inches/hour/cfm (231.5 cc/hr/m^3/min)
- Type of oil mist fitting: Spray type

6.4 OIL CHANGE

The first oil change should be carried out three weeks after commissioning; all further oil changes take place every six months. However, replenish oil as necessary when level falls below the middle of the oil sight glass.

- Only change the oil when the machine is switched off.

- The drained oil is hot, and can cause severe burns.

Refer to *SECTION 6.1.1-Recommended Lubricant* for recommended oil types and to *SECTION 6.1.3-Quantity* to ensure the proper quantity according to the frame size of your pump.

The oil change should be carried out as follows:

1. Switch the drive motor off.
2. Drain the oil out and clean the bearing frame with a suitable cleaning liquid. Flushing the bearing frame with clean lightweight oil is possible (e.g. ATF).
3. Remove the breather connection located at the top of the bearing frame and pour the oil. If pump has the optional constant level oiler, leave an amount equal to the constant level bottle apart. Place the breather connection back on its position and, if applicable, fill the constant level oiler with the remaining oil and place it in its place.
4. The level at the oil sight glass should be at the middle.

SECTION SEVEN - OPERATION

7.1 PRIMING

Pumps handling hot (>500 °F, >260 °C) fluids must be gradually preheated to operating temperature. The most common method used for warming a pump, or maintaining a standby pump in a warm condition, is the use of a warming line and orifice, thus circulating the hot pumpage through the idle pump.

- It is recommended that the pump be warmed at the rate of 100 °F (55 °C) rise per hour for normal warming, or 268 °F (149 °C) rise per hour for emergency warming.

- It is recommended that the idle pump temperature be maintained within 36 °F (20 °C) of the system operating temperature.

Circulation can be easily accomplished by guiding a small amount of flow from the discharge side of the system beyond the check valve via a multiple breakdown orifice into the bottom of the pump case. The hot liquid will then pass through the case and out the suction and return to some low pressure point in the system. In many cases, the pump drain line is used for the warming connection.

Note: Many variations are possible and one that is compatible with the customer's particular installation should be considered.

7.2 STARTUP

- Every time before the pump is started up the safety devices must be mounted and fastened.

- In order to avoid risks of injury or damage, all pump units must be equipped with emergency-stop devices.

- For operation of electrical drives, control systems and their cable routes, the safety instructions issued by their manufacturers must be observed.

- When the pump is shipped with a cartridge mechanical seal type installed, the setting devices on the seal collar might be engaged. In this case, it is necessary to tighten the set screws, disengage these setting devices from the seal, and turn them to allow the operation of the pump. To perform this procedure, please follow the instruction manual from the seal manufacturer.

Figure 7.1. Seal setting devices.

The startup procedure is as follows:

1. Before starting the pump, check the security of all bolting, piping, and wiring.
2. Check all gauges, valves and instruments for proper working order.
3. Check all equipment for proper lubrication and correct rotation.
4. Verify that the discharge valve is closed.
5. Open the suction valve.
6. Open discharge valve and allow pump to fill with fluid (pump is self-venting).
7. Keep the valves open approximately 60 seconds to ensure that pump is completely full of fluid.
8. Close discharge valve.
9. Uncouple the driver and the pump.
10. Start, and **IMMEDIATELY STOP**, the driver and observe the rotation of the shaft.
11. Correct rotation should be in direction of rotation arrow.

- If shaft rotation is incorrect, consult driver manufacturer's instructions in order to change rotation.

12. Priming accomplished and correct shaft rotation established, the pump is ready for continued operation.
13. Securely couple the driver and the pump, and ensure the discharge valve is open to approximately ¼ fully open.
14. Start driver again, and completely open the discharge valve **IMMEDIATELY** when the operating speed has been reached.

- Danger: Do not allow discharge valve to remain closed for any length of time. Pumped fluid temperature will rise excessively causing damage to pump.

7.3 OPERATING CHECK

During the initial operating hours, the pump should be monitored constantly. It is thus possible to detect irregularities immediately and to take appropriate measures for their elimination (See *SECTION ELEVEN - TROUBLESHOOTING CHART*).

To monitor flow, pressure, temperature, and lubrication, regular visual inspection and monitoring is advisable and/or necessary during operation.

Ruhrpumpen recommends checking the pump constantly at regular intervals in order to detect problems early, in case they arise.

The operational check routine must include at least the following points:

- Beware of freely rotating parts, when the pump is in operation there is a high risk of injury.

- Check at regular intervals that the safety equipment is sound and is arranged and fastened according to the regulations, and energized where applicable.
- Check the security of all bolting, piping, and wiring.
- Check all gauges, valves, and instruments for proper working order.
- Check all equipment for proper lubrication and correct rotation.
- Check the oil level and validate that the correct oil grade is installed.
- Check that the pumping unit is running quietly and without vibrating.

- Unusual or too loud noises point towards a possible fault.

- Monitor the power consumption of the drive motor. Low or excessive power consumption indicate a possible fault.
- Check the sealing system:
    a. Refer to the seal manufacturer for his estimate of maximum acceptable leakage rate, as this will depend on application, design, location, and the sealed liquid characteristics.
    b. If leakage is excessive, switch the pump off as quickly as possible, isolate the pump by closing the discharge and suction valves or by using some other approved method designated as safe for your system, and check the rotating seal ring and the stationary seal ring.

- If the sealing system of the mechanical seal fails, the pump must be taken out of operation immediately.

- The pump may only be operated under the minimum operating range for short periods. The minimum pump flow is given in the characteristic line.

7.4 DOWELING (OPTIONAL)

When the pump has reached operating temperature and pressure,

1. Stop pump.
2. Check alignment and reset the equipment, if required.
3. Dowel the pump (if applicable).
4. Dowel the driver.
5. Start the pump as defined in *SECTION 7.2-STARTUP*.

7.5 STOPPING

1. Throttle pump discharge to minimum flow.

- Warning: do not close suction valve, this will cause the pump to run dry.

2. Turn the power off to the driver.
3. Close the pump discharge valve.

4. Observe the run-down of the pump until full stop.

- If the rotor is jerky or suddenly stops, there is danger that the rotor has become blocked. The pump must be opened and all running clearances checked.

5. Close the suction valve when the pump shaft stops rotating as the pump must be isolated before examination and made safe.

- Do not close the suction valve until the pump has come to a full stop, as it may cause the pump to run dry.

6. Ensure the drive motor cannot be unintentionally turned on.
7. Ensure the shut-off devices in the suction and pressure pipes cannot be unintentionally opened.
8. Drain the pump and the auxiliary piping.

- If the outside temperature is below 32 °F (0 °C), all cooling chambers must be emptied, and all seal system cooling coils must be drained.

7.6 SHORT-TERM SHUTDOWN

If the pump was switched off correctly and has not suddenly come to a halt, it may be re-started without the need to take any special measures.

If the pump comes to a sudden halt, or if the pump was switched off because of a possible danger, it must be checked for damage.

7.7 LONG-TERM SHUTDOWN

1. Follow the stopping procedure described in *SECTION 7.5-STOPPING.*
2. Disconnect the vent filter and seal openings on the bearing frame to lessen the exchange of air.
3. While the unit is idle:
    a. If the plant is in an operational state, warm up and start the unit at monthly intervals (see *SECTION 7.2-STARTUP* for details).

b. If the plant is not in an operational state, turn the unit over by hand a couple of times at monthly intervals, ensuring the shaft is not returned to the same position, to allow the bearings to rest in a different position every time.

4. If there is danger of freezing, drain the pump, drain the oil from the pump bearings and all the auxiliary piping.
5. Change the oil before recommencing operation, ensuring the correct grade and the correct volume has been filled in the bearing frame (see *SECTION SIX - LUBRICATION* for details).

SECTION EIGHT – MAINTENANCE

To perform the maintenance of the pump, no special (custom made) tools are needed.

- Before initiating maintenance procedures disconnect all power sources to the equipment and discharge any parts which may retain an electric charge. Use proper locks to avoid accidental start-up of the pump system. Failure to comply may result in severe personal injury.

- When performing the maintenance of the pump, use the safety equipment appropriate for the pumped fluid, materials, and location of the equipment, such as gloves, safety glasses, harnesses and other equipment regarded as mandatory by the plant's safety instructions.

8.1 DISASSEMBLY

1. Stop the pump. See *SECTION 7.5-STOPPING*.
2. Drain all possible fluids from the pump case and power frames.
3. Disconnect any auxiliary piping and wiring that could interfere with disassembly (for example, cooling coil or cooling jacket piping).
4. Disconnect the driver-to-pump coupling and remove coupling spacer.
5. When disassembling the pump, match mark, tag or otherwise identify all parts, and provide separate containers for small parts. Refer to the pump sectional drawing included in *SECTION TEN - PARTS INFORMATION* for proper identification of parts.
6. To separate pump cover from pump case, first remove the bolts, then use back-off screws in the taps provided to break the cover-to-case gasket joint.
7. Remove the pump cover-power frame assembly by providing a chain or sling support for the assembly.

- Avoid bumping the impeller or the pump half coupling.

8. After removal, place the pump cover-power frame safely on suitable horizontal supports.
9. To remove the impeller, first free and remove the cover-to-case gasket.

- Do not heat the impeller.

10. Exercise care and remove mechanical seal as follows:
    a) If seal has an outside drive collar, engage seal setter, then loosen set screws prior to removal of assembly.
    b) Remove power frame-to-cover cap screws.
    c) Slide pump cover, with seal attached, off pump shaft. Place the cover, with seal flange facing upward, on worktable.
    d) Apply protective wrap and store seal components. Refer to seal manufacturer's literature for disassembly, inspection, cleaning, and reassembly of the mechanical seal.
11. Disassemble the power frame as follows:
    a) Remove pump half coupling and key. Application of heat is required for the removal and replacement of pump half coupling. Use a puller tool to remove the pump half coupling.

- Use a safe heating method and provide protection for personnel handling the heated half coupling.

    b) Pump shaft can be removed in two directions. In power frames 10, 30-A and 50, press pump shaft from impeller end through the power frame. Remove radial bearing from shaft. Remove lock nut and lock washer and remove thrust bearings from shaft. For CPP-L pumps, the rotor is removed towards the coupling for all the power frames regardless of their size.

8.2 INSPECTION AND CLEANING

1. Thoroughly clean all parts and dry with compressed air or a clean, lint-free cloth.
2. Inspect all components for corrosion, erosion, pitting, and scoring. If required, replace with Ruhrpumpen O.E.M. genuine replacement parts.
    a. Visual check all individual parts for any damage.
    b. Check the case for wear.
    c. Check the impeller for wear.
    d. Check the radial clearance for wear.
    e. Check the antifriction bearings.
    f. Check all auxiliary piping.

g. Check for transmission elements of the coupling.

8.3 REASSEMBLY

· Observe the plant's safety precautions when lifting heavy components. Request help when moving or positioning them.

· Mounting of bearings should be carried out in a dry, dust-free area away from metal working or other machines producing shavings and dust to avoid contamination of bearings.

· The bearings should remain in their original packaging. Once they are to be assembled in the shaft, they must be removed from their packaging, and the preservative in the outside diameter and the bore must be wiped out.

· Bearings should be demagnetized before mounting them, to avoid contamination.

8.3.1 CPP21

Please follow the steps detailed on this section to reassemble the CPP21 pump. To reassemble the CPP-L pump, please refer to *SECTION 8.3.2-CPP-L*.

1. Place and heat the thrust bearing in an induction heater. Turn on the heater. Continuously measure the temperature of the inner race, looking to reach 230 °F (110 °C).

· Measure the temperature continuously with an infrared thermometer, pointing to the inner race of the bearings.

Figure 8.1. Heating the thrust bearing.

2. Position the shaft vertically (with the coupling side upward) in a press.

ATTENTION

- Cover the jaws of the press with soft material to prevent damaging the shaft.

3. As soon as the bearing has reached the temperature of 230 °F (110 °C), place the thrust bearing on the shaft (with the serial number visible from the outside). Keep the bearing in position until it cools down enough to stay in place.

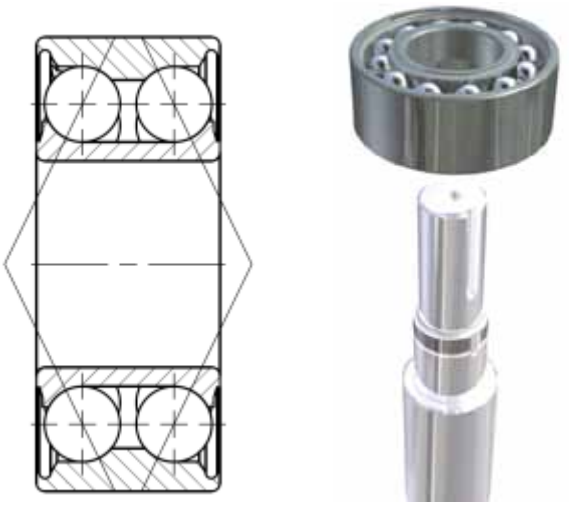


Figure 8.2. Positioning the thrust bearing.

- Wear sufficient hand protection to avoid personal injury.

- Important: Wait until the bearing has cooled down to room temperature before starting the next step. This cooling period is critical to ensure the final contraction of the bearing before the next adjustments.

4. Position the lock washer so that it is in contact with the thrust bearing on the coupling side. The tab on the lock washer inner diameter must be bent to fit into the small keyway recess cut into shaft threads, to prevent rotation of the bearing lock nut.

Figure 8.3. Positioning the lock washer.

5. Position the locknut with the taper towards the side of the lock washer at full-stop.

Figure 8.4. Positioning the locknut.

6. Now take the shaft out of the press and turn it over 180°, place it back in the press to reassemble the radial bearing.

    a. Place the radial bearing in the induction heater. Turn on the heater. Continuously measure the temperature of the inner race, looking to reach 230 °F (110 °C).

ATTENTION

· Measure the temperature continuously with an infrared thermometer, pointing to the inner race of the bearing.

Figure 8.5. Heating the radial ball bearing.

7. As soon as the bearing reaches the 230 °F (110 °C) temperature, it is manually positioned in the shaft (with the serial number visible from the outside). The bearing is maintained in position until it cools down enough to stay in place (to room temperature).

- Wear sufficient hand protection to avoid personal injury.

- Protect the bearings with oil and cling wrap plastic if you are not going to continue the assembling process immediately. When resuming the assembling process, remove this protection.

8. Place the rotor assembly in the power frame. There are two possible options depending in the power frame size.
    a. Power frame 30-B: Install de rotor from the pump side.

Figure 8.6. Positioning the rotor assembly on the power frame (from pump side).

    b. Power frames 10, 30-A and 50: Install the rotor from the coupling side.

Figure 8.7. Positioning the rotor assembly on the power frame (from coupling side).

9. Tighten the bearing lock nut as tight as possible by hand using a spanner wrench. Ensure at the end of the tightening process that one of the lock washer tabs lines up with the slot in the locknut.

Figure 8.8. Tightening the locknut.

10. The tab that aligns with one of the slots is bent into the slot so it works as a lock and the locknut cannot be loosened. Use a screwdriver and a hammer.

Figure 8.9. Bending a tab of the lock washer in the locknut.

- Wear sufficient hand protection to avoid personal injury.

11. To insert the labyrinth seals into the covers, follow these steps:

    a. Lubricate the outside ring of the labyrinth seal. Lubricant supplied by isolator manufacturer or P-80 Rubber Lubricant Emulsion is recommended (grease is NOT recommended).

Figure 8.10. Lubricating the labyrinth seal.

    b. Position the labyrinth seal at the bearing cover in its correct position (with the internal drain slot of the labyrinth seal at the 6 o'clock position of the bearing cover).

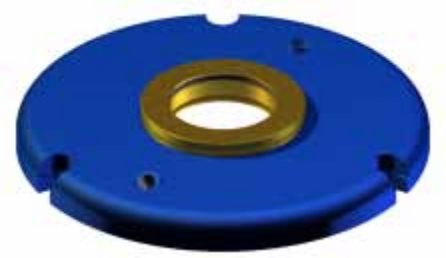


Figure 8.11. Labyrinth seal and bearing cover.

    c. Ensure the labyrinth seal is perpendicular to bore before insertion.

    d. Using a sleeve and a flat surface (hard plastic) with the help of an arbor press, insert the labyrinth seal.

Figure 8.12. Inserting the labyrinth seal.

ATTENTION

· Do not use a hydraulic press, since the seal can be broken.

e. Perform this procedure on both covers.

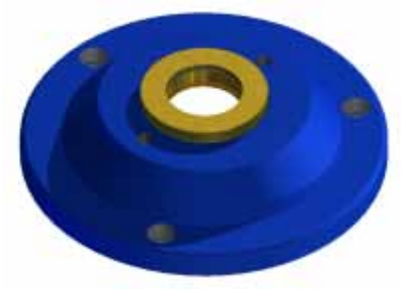


Figure 8.13. Repeating the process for each cover.

12. Position the radial O-ring at the cover. Position manually the cover on the power frame, ensuring the cover is rotated in the correct position.

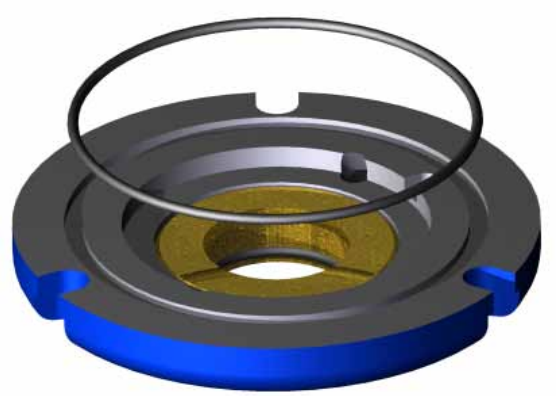


Figure 8.14. Positioning the radial O-ring.

13. To position the radial cover at the power frame, first put some lubricant (provided by the supplier) in the inner diameter of the radial labyrinth seal.

Figure 8.15. Lubricating the radial labyrinth seal.

14. Position the bolts manually. Now tighten these bolts diagonally (crosswise) to ensure correct reassembly.

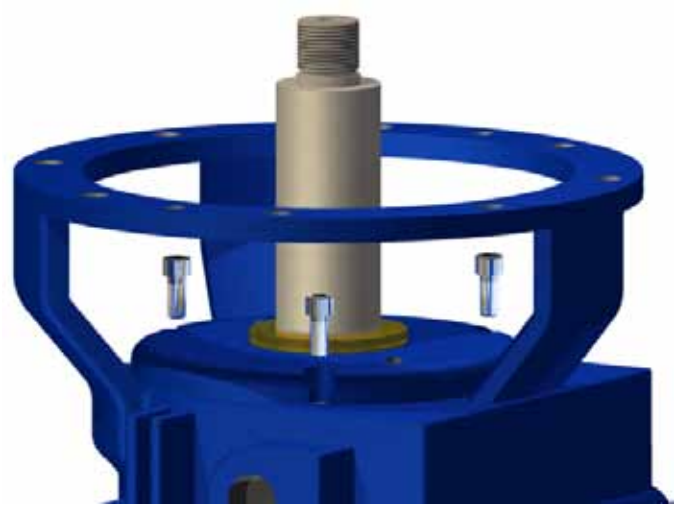


Figure 8.16. Radial cover assembly.

ATTENTION

- Inspection point: Check that the bearings enter evenly in the frame; the bearing should rest against the wall of the power frame. After this assembly, the shaft must be able to rotate by hand; however, there is some resistance to make it turn due to the action of the labyrinth seals.

15. To position the thrust cover at the power frame, first position the thrust O-ring in the cover.

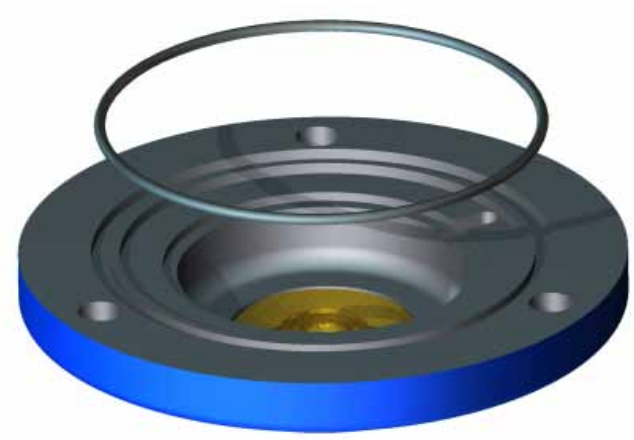


Figure 8.17. Positioning the thrust O-ring in the cover.

16. Lubricate the internal diameter of the labyrinth seal. Lubricant supplied by isolator manufacturer or P-80 Rubber Lubricant Emulsion is recommended (grease is NOT recommended).

Figure 8.18. Lubricating the internal diameter of the labyrinth seal.

17. Slide cover onto the shaft, ensuring cover is rotated to the correct position (do not use a hammer).
18. Position the bolts manually. Tighten these bolts diagonally (crosswise) to ensure correct reassembly.

Figure 8.19. Thrust cover assembly.

19. Use the proper wrench to install plugs, sight glass, breather and any other necessary plug.

Figure 8.20. Identifying the plugs in the bearing frame.

ATTENTION

· Apply pipe tape sealant only if it is a pass-through thread (except for the vent).

ATTENTION

- Inspection point: Check visually that all the threads in the power frame have a plug installed (no thread should remain free after this step).

20. Install the plugs in the case cover.

Figure 8.21. Identifying the plugs in the case cover.

ATTENTION

- Apply pipe tape sealant only if it is a pass-through thread.

ATTENTION

- Inspection point: Verify that the plugs are not in contact with the mechanical seal head.

Figure 8.22. Verifying the plugs do not interfere with mechanical seal head.

21. The wear rings at the impeller, case, and case cover are optional. To insert the wear rings, follow these steps:

    a. Each of the wear rings of the impeller (two, one for each side) is inserted into its position (to the limit where it stops) using a press or a rubber mallet.

Figure 8.23. Positioning the wear rings of the impeller.

b. Insert the wear ring completely in the shoulder of the case using a press.

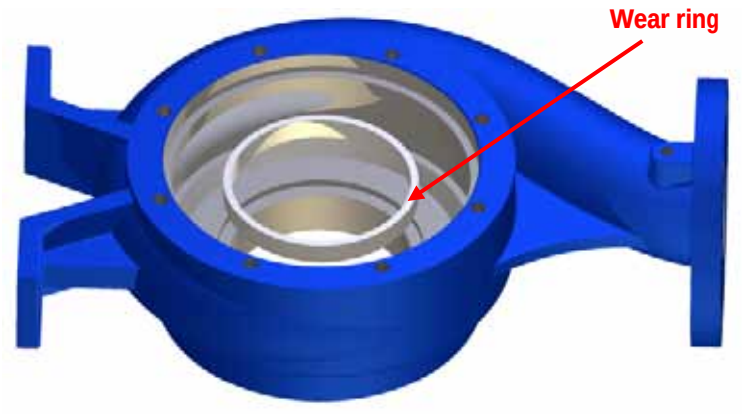


Figure 8.24. Positioning the wear ring.

c. Insert the wear ring completely in the shoulder of the case cover using a press.

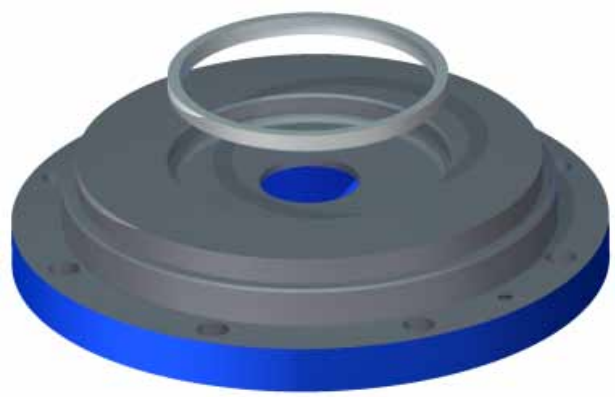


Figure 8.25. Positioning the wear ring.

22. To position the mechanical seal in the power frame, first check the drawing of the mechanical seal, to be sure of assembling the seal at its correct position. Now:

    a. Grease the mechanical seal ring and install it manually in the mechanical seal head.

Figure 8.26. Positioning the mechanical seal ring.

b. Grease the joint of the mechanical seal head and install it in the internal diameter.

Figure 8.27. Positioning the mechanical seal joint.

c. Insert the mechanical seal head in the shaft until tight.

Figure 8.28. Positioning the mechanical seal head.

d. Grease the seal's rotary face and install it in the shaft to the limit with the mechanical seal head.

Figure 8.29. Positioning the rotary face.

e. Install the spring in the shaft.

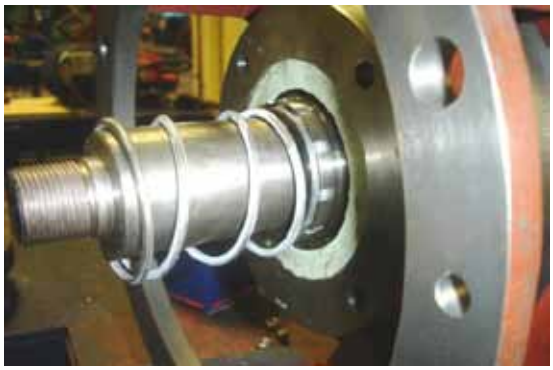


Figure 8.30. Positioning the spring in the shaft.

f. Install the two set screws in the spacer.

Figure 8.31. Positioning the set screws.

g. Install the spacer in the shaft. Place the spacer at 0.3125 (5/16) inch (7.9 mm) from the face of the shaft.

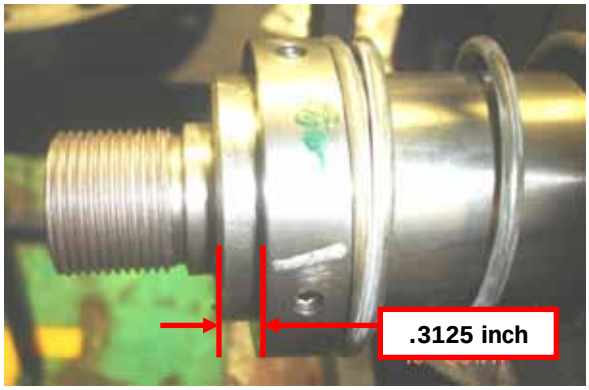


Figure 8.32. Positioning the spacer.

h. Tighten the set screws to set the spacer in that position.

Figure 8.33. Fixing the spacer in the shaft.

23. To install the four studs in the case cover, follow these steps:

a. Place the four studs in the case cover by hand.

Figure 8.34. Positioning the studs in the case cover.

b. Position two paired nuts in the stud to be tighten.

Figure 8.35. Paired nuts to tighten the stud.

c. Tighten both nuts as shown.

Figure 8.36. Tightening the paired nuts.

d. Use the spanner to tighten the stud.

Figure 8.37. Tightening the studs.

e. Loosen the two nuts as shown.

Figure 8.38. Removing the nuts.

f. Repeat these steps to tighten each of the remaining studs.

24. Install the case cover in the power frame.

Figure 8.39. Installing the case cover.

25. Position the screws to hold the case cover with the power frame.

Figure 8.40. Positioning the screws to hold the case cover.

26. Position the o-ring in the impeller.

27. Apply antiseize protection on the shaft thread and position the impeller. With a torque spanner, on the shaft at the coupling side, lock the rotation of the shaft. Rotate the impeller to tighten it to the possible extent.

Figure 8.41. Locking the shaft rotation.

28. Install the studs and nuts in the mechanical seal head.

Figure 8.42. Setting the mechanical seal.

29. Place the gasket in the case. Use packing grease to hold the gasket in place.

ATTENTION

- The case gasket must be changed every time the case and the case cover are disassembled and reassembled.

30. To assemble the power frame with the case, follow these steps:
    a. Position the case vertically, supported over the suction.
    b. Lift the assembly of the power frame and position it over the case shoulder.

Figure 8.43. Positioning the power frame assembly on the case.

c. Position the bolts by hand.

d. Tighten these bolts diagonally (crosswise) to ensure the correct assembly.

· Make sure that the vent of the power frame is oriented towards the discharge of the pump.

· Inspection point: Rotate the shaft and make sure the wear rings do not make contact. After positioning the pump horizontally, rotate the shaft to verify again that the wear rings do not make contact.

8.3.2 CPP-L

The CPP-L pump shares reassembly steps 1 through 5, and 23 through 30, with the CPP21 pump. Please follow the aforementioned steps from the CPP21 pump reassembly procedure found in *SECTION 8.3.1-CPP21* when reassembling the CPP-L pump. Intermediate steps to reassemble the CPP-L pump, steps 6 through 22, are the following:

6. Tighten the bearing locknut as tight as possible by hand using a spanner wrench. Ensure at the end of the tightening process that one of the lock washer tabs lines up with the slot in the locknut.
7. The tab that aligns with one of the slots is bent into the slot so it works as a lock and the locknut cannot be loosened. Use a screwdriver and a hammer.

· Wear sufficient hand protection to avoid personal injury.

8. Now take the shaft out of the press and turn it over 180°, place it back in the press to reassemble the radial bearing. Insert the bearing retainer in the shaft before installing the radial bearing**.**

a. Place the radial bearing in the induction heater. Turn on the heater. Continuously measure the temperature of the inner race, looking to reach 230 °F (110 °C).

ATTENTION

· Measure the temperature continuously with an infrared thermometer, pointing to the inner race of the bearing.

Figure 8.44. Heating the radial ball bearing.

9. As soon as the bearing reaches the 230 °F (110 °C) temperature, it is manually positioned in the shaft (with the serial number visible from the outside). The bearing is maintained in position until it cools down enough to stay in place (to room temperature).

Figure 8.45. Positioning the radial bearing.

· Wear sufficient hand protection to avoid personal injury.

ATTENTION

· Protect the bearings with oil and cling wrap plastic if you are not going to

continue the assembling process immediately. When resuming the assembling process, remove this protection.

10. To insert the thrust labyrinth seal into the bearing carrier, follow these steps:

    a. Lubricate the outside ring of the labyrinth seal. Lubricant supplied by isolator manufacturer or P-80 Rubber Lubricant Emulsion is recommended (grease is NOT recommended).

Figure 8.46. Lubricating the labyrinth seal.

    b. Position the labyrinth seal at the bearing carrier in its correct position (the grooves of the oil return must be placed on the inside of the bearing carrier).

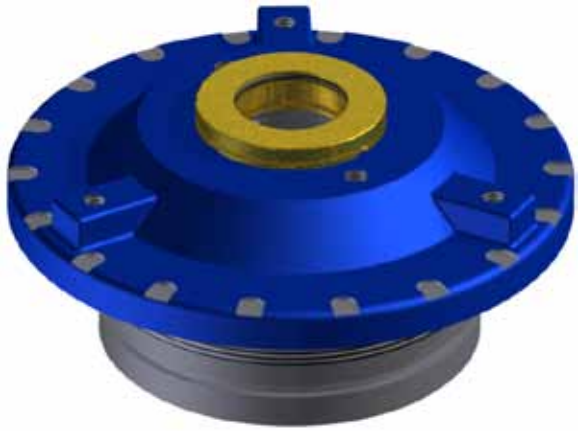


Figure 8.47. Labyrinth seal and bearing carrier.

    c. Ensure the labyrinth seal is perpendicular to bore before insertion.

    d. Using a sleeve and a flat surface (hard plastic) with the help of an arbor press, insert the labyrinth seal.

Figure 8.48. Inserting the labyrinth seal (image for illustration purposes, it is not the bearing carrier).

ATTENTION · Do not use a hydraulic press, since the seal can be broken.

e. Perform this procedure on radial cover.

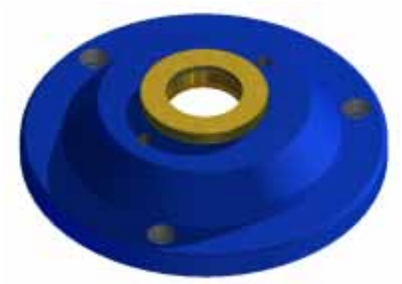


Figure 8.49. Repeating the process for radial cover.

11. Slide the bearing carrier over the outer race of the thrust (axial) bearing to the limit where it stops.
    a. First put some lubricant (provided by the supplier) in the inner diameter of the thrust labyrinth seal.

Figure 8.50. Sliding bearing carrier.

12. Compress the circlip with the appropriate tool and insert it in the inner groove of the bearing carrier.

Figure 8.51. Compressing and inserting the circlip.

13. Position the two O-rings of the bearing carrier in their grooves. Be careful when placing the O-rings in their matching grooves, since they are of different sizes.

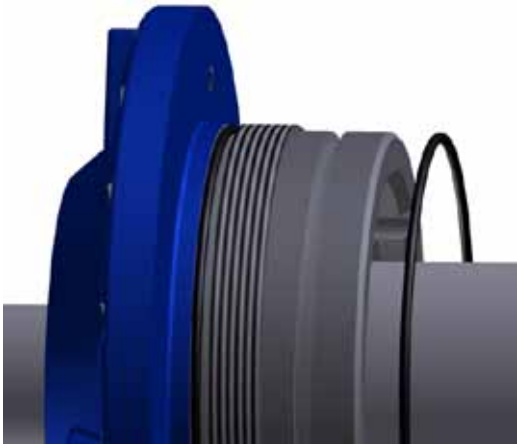


Figure 8.52. Positioning the O-rings.

14. The subassembly of shaft, bearings and bearing carrier may be installed in the frame of the pump.
    a. The thread of the bearing carrier and de O-rings should be lubricated with oil before installing it.

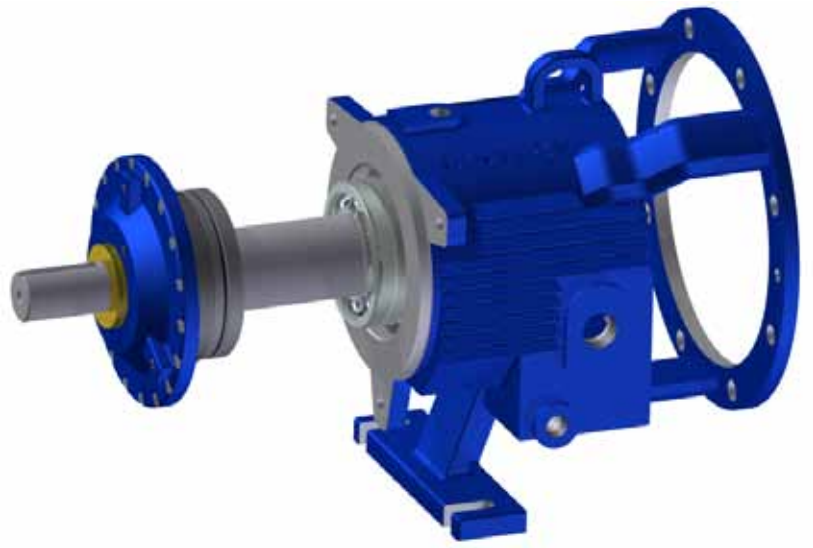


Figure 8.53. Installing subassembly in power frame.

15. Thread the bearing carrier in the frame clockwise, until the flange of the bearing carrier reaches to approximately 0.100 inches (2.5 millimeters) of the frame.
16. Install the set screws loosely.

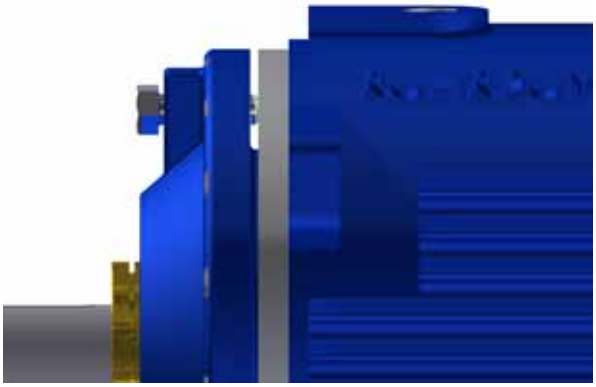


Figure 8.54. Installing the set screws.

17. Position the radial O-ring at the cover. Position manually the cover on the power frame, ensuring the cover is rotated in the correct position.

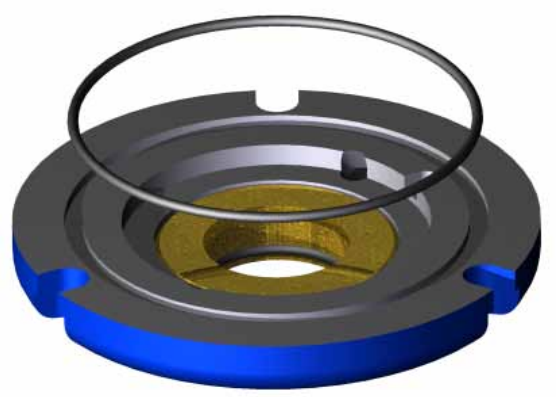


Figure 8.55. Positioning the radial O-ring.

18. To position the radial cover at the power frame, first put some lubricant (provided by the supplier) in the inner diameter of the radial labyrinth seal.

Figure 8.56. Lubricating the radial labyrinth seal.

19. Position the bolts manually. Now tighten these bolts diagonally (crosswise) to ensure correct reassembly.

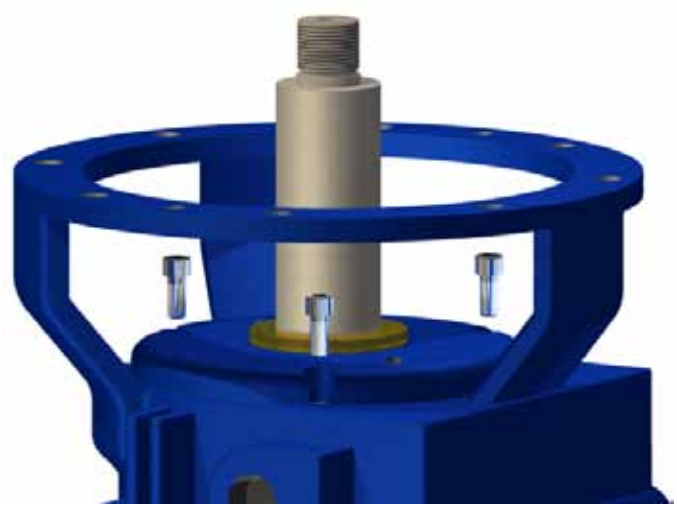


Figure 8.57. Radial cover assembly.

ATTENTION

· Inspection point: Check that the bearings enter evenly in the frame; the bearing should rest against the wall of the power frame. After this assembly, the shaft must be able to rotate by hand; however, there is some resistance to make it turn due to the action of the labyrinth seals.

20. Use the proper wrench to install plugs, sight glass, breather and any other necessary plug.

Figure 8.58. Identifying the plugs in the bearing frame.

ATTENTION

· Apply pipe tape sealant only if it is a pass-through thread (except for the vent).

ATTENTION

· Inspection point: Check visually that all the threads in the power frame have a plug installed (no thread should remain free after this step).

21. Install the plugs in the case cover.

Figure 8.59. Identifying the plugs in the case cover.

ATTENTION · Apply pipe tape sealant only if it is a pass-through thread.

ATTENTION · Inspection point: Verify that the plugs are not in contact with the mechanical seal head.

Figure 8.60. Verifying the plugs do not interfere with mechanical seal head.

22. Insert the adapter ring completely in the shoulder of the case cover using a press.
    a. Align the hole in the adapter ring at the 6 o'clock position as shown in the next figure. Use as reference both threaded holes in the case cover.

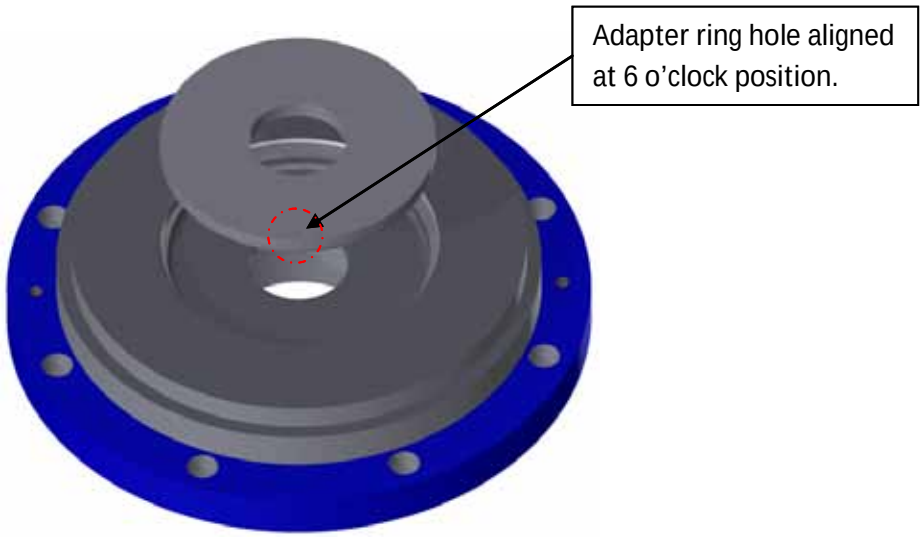


Figure 8.61. Positioning the adapter ring.

8.3.2.1 CPP-L Impeller Clearance Adjustment

This section applies for the CPP-L pump with bearing carrier.

The adjustment of the impeller should be performed with the pump casing. Depending on the operating conditions is how the impeller clearance should be adjusted, and if those conditions change, the adjustment should be redone according to the new operating conditions.

Temperature in °F (°C)	Clearance in inches (mm)
< 200 (93)	0.018 ± 0.003 (0.46 ± 0.08)
200 to 250 (93 to 121)	0.021 (0.53)
251 to 300 (122 to 149)	0.024 (0.61)
301 to 350 (150 to 176)	0.027 (0.69)
351 to 400 (177 to 204)	0.030 (0.76)
401 to 450 (205 to 232)	0.033 (0.84)
>450 (232)	0.036 (0.91)

The following figure illustrates the impeller clearance, which is the clearance between the impeller and the casing.

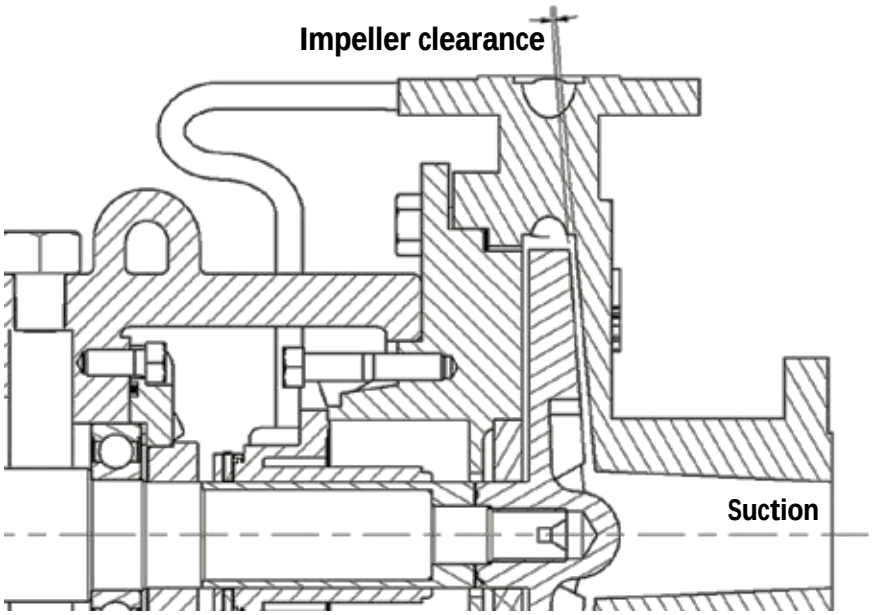


Figure 8.62. Indication of impeller clearance.

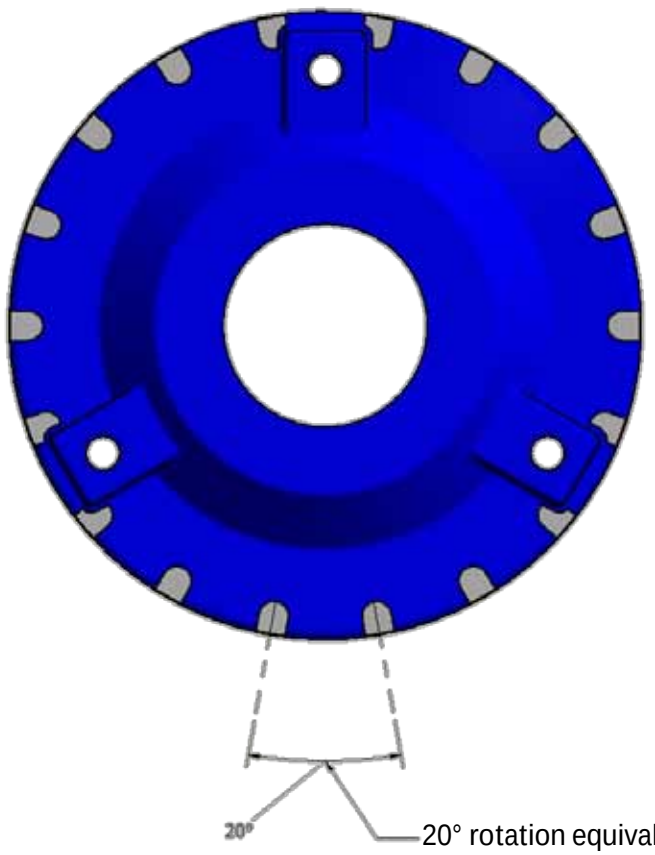
Adjustment of impeller clearance

ATTENTION

· The axial adjustment to determine the clearance between the impeller and the casing should not be performed with the mechanical seal fixed, as this could damage the mechanical seal.

To perform the thrust adjustment of the impeller, loosen the screws of the carrier and turn it until the clearance needed between the impeller and the casing is reached. Turn the bearing carrier clockwise until the impeller lightly rubs the casing. Now turn the bearing carrier counterclockwise to get the correct clearance between the impeller and the casing (as shown on the table).

Turning the carrier through each mark represents a 20° turn and an axial movement of 0.003 in (0.0762 mm). The recommended procedure is to mark the origin of the adjustment with a marker, and then divide the dimension of the required clearance by 0.003 in (0.0762 mm), to determine how many marks the turning of the carrier has to cover. Once the angular displacement has been defined, make a second mark with the marker to ensure a correct adjustment. This axial displacement has to be compensated because the carrier is displaced 0.002 in (0.05 mm) when tightening the screws to lock the carrier.



20° rotation equivalent to 0.003 in (0.0762 mm) of axial movement.

Figure 8.63. Rotation equivalence to linear axial displacement.

8.3.3 Coupling Guard Assembly

Please follow these steps to assemble the coupling guard.

1. Before installing the coupling guard in the pump, the coupling must be properly mounted and aligned. For more details, see *SECTION 5.2-ALIGNMENT*.

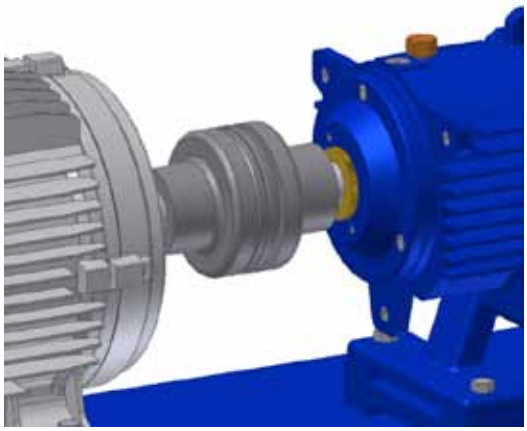


Figure 8.64. Coupling already mounted and aligned.

2. Put together the lower pump side cover with the motor side cover.

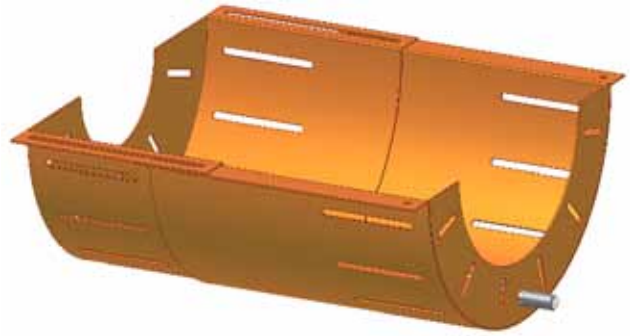


Figure 8.65. Putting together the lower pump and the motor side covers.

3. Position both components in the lower side of the coupling. Insert the bolt of the lower cover in one of the frame supports as shown. Tighten the ½ inch (12.7 mm) nut by hand to support the two components.

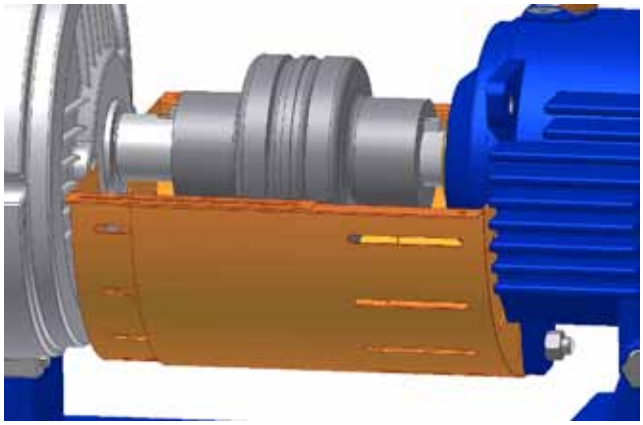


Figure 8.66. Positioning lower components of the coupling guard.

4. Position the second (upper) motor side cover and secure the component with a bolt, a washer, and a nut on each side. Tighten the bolts by hand to allow both motor side covers to slide to adjust the coupling guard length.

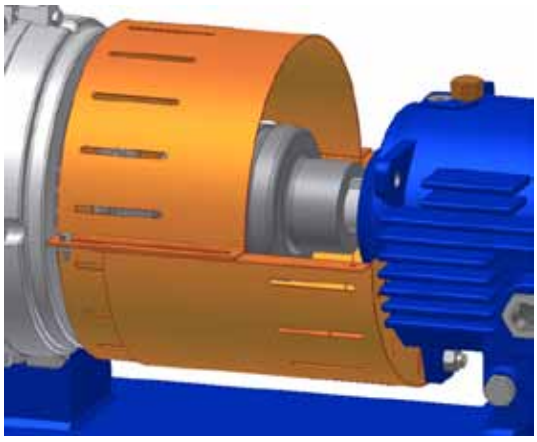


Figure 8.67. Positioning and securing second motor side cover.

5. Position the pump side upper cover and insert the two bolts in the upper frame supports. Install the nuts to secure the coupling guard assembly and tighten by hand.

Figure 8.68. Positioning and securing upper pump side cover.

6. Position the bolts, washers, and nuts in both the slot and hole on each side of the pump side covers and tighten by hand.

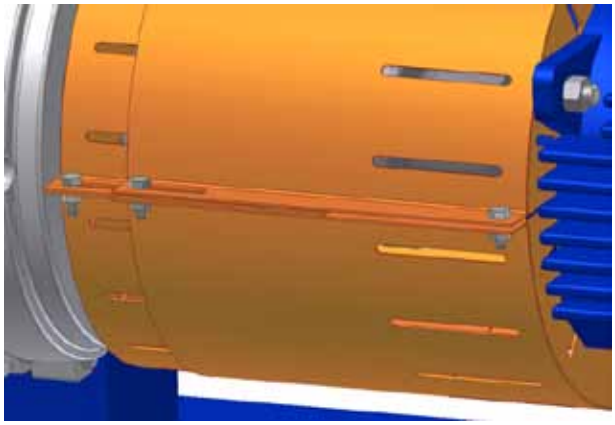


Figure 8.69. Positioning bolts, washers, and nuts on the upper and lower pump side covers.

7. Before tightening all bolts and nuts with a spanner, adjust the length of the coupling guard to close the distance between the coupling guard and the motor to approximately ⅛ inch (3.175 mm).

8. Tighten all the bolts and nuts with a spanner to rigid the assembly.

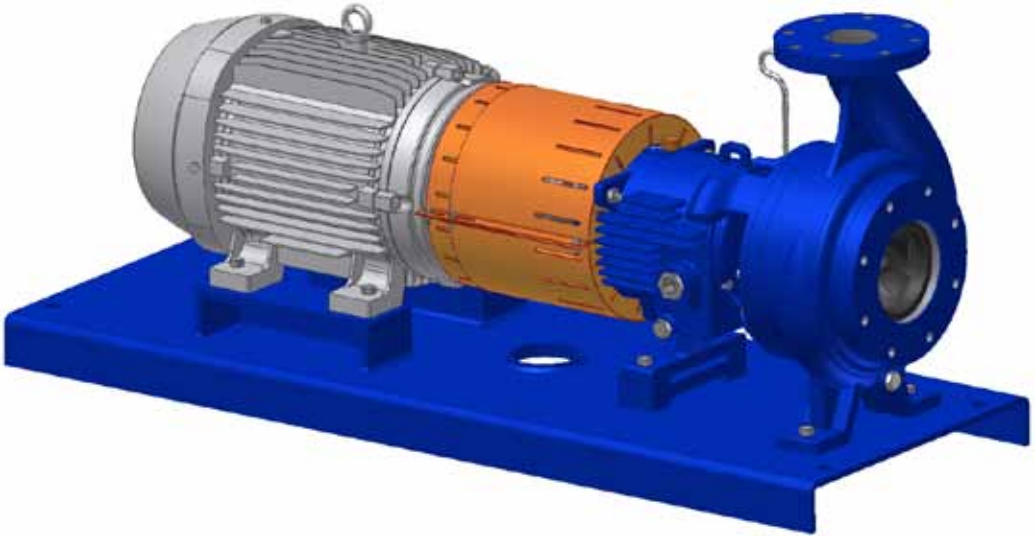


Figure 8.70. Coupling guard assembly.

8.3.4 C-Frame Assembly

For the C-Frame option, follow the next steps for its installation:

1. Once the pump is installed over the baseplate, position the half coupling over the shaft of the pump and the other half coupling over the shaft of the motor. The shaft of the pump as well as the shaft of the motor should be 1/16" inside the half coupling to make sure that later the spacer coupling may be removed without hassle. Tighten the set screws of both half couplings.

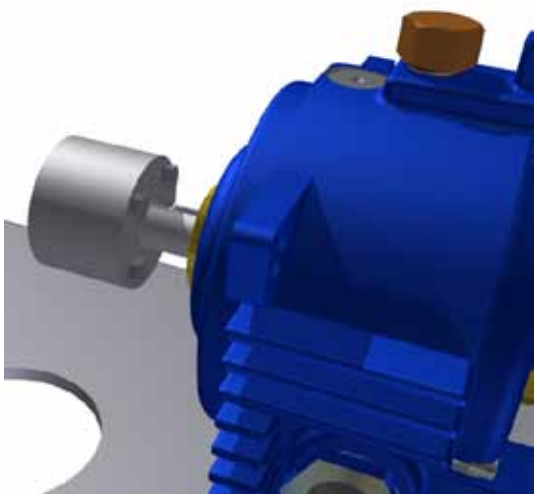


Figure 8.71. Positioning the half couplings.

2. Position the C-Frame over the register of the frame on the coupling side.

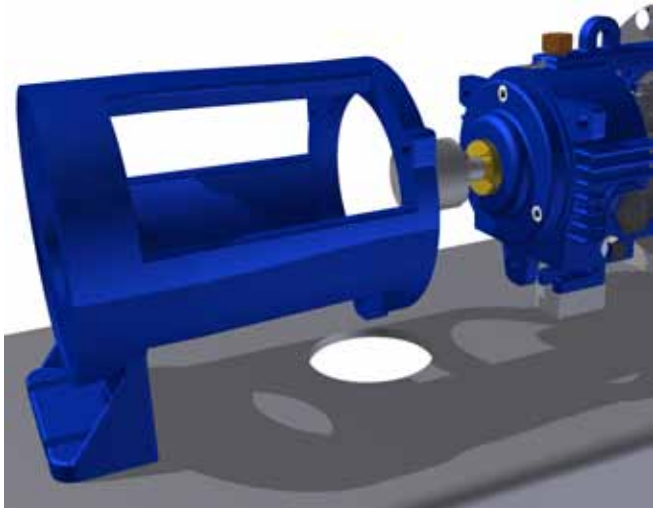


Figure 8.72. Positioning the C-Frame.

3. Place the three screws of the C-Frame and tighten them diagonally (crosswise).

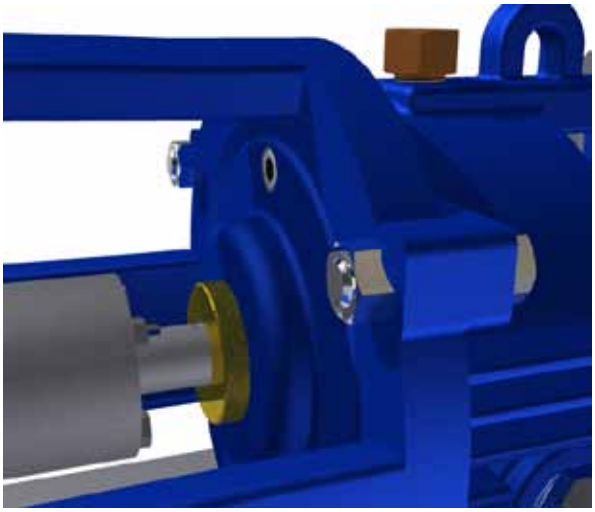


Figure 8.73. Placing and tightening the screws to the frame, crosswise.

4. Place the hex screws of the C-Frame to fix it to the baseplate. Tighten the hex screws.

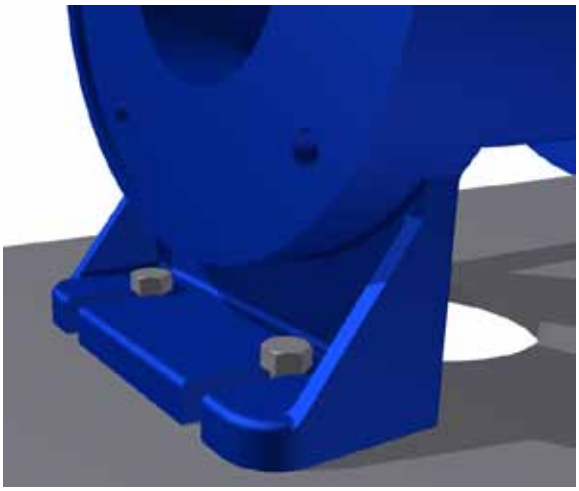


Figure 8.74. Securing the C-Frame to the baseplate.

5. With the help of a crane or hoist, install the C-Face motor (driver) over the register of the C-Frame.
6. Position the four screws that secure the motor (driver) and tighten them crosswise.

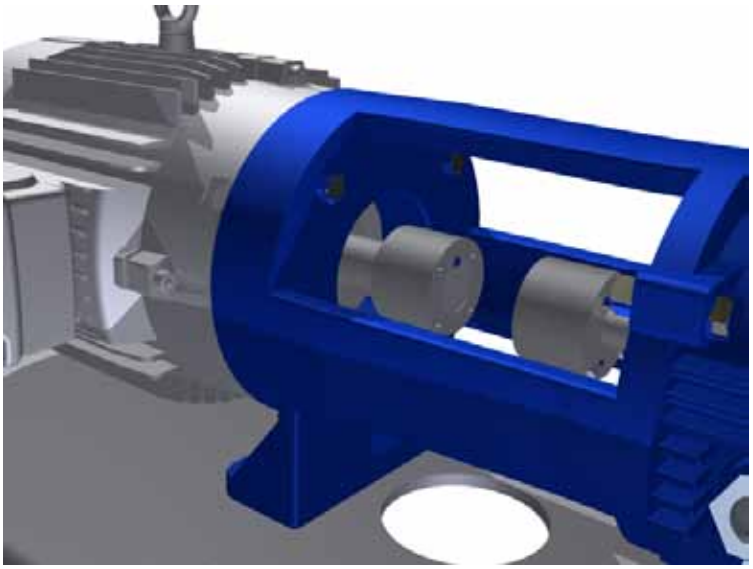


Figure 8.75. Securing the C-Face motor (driver) to the C-Frame.

7. There is no need to align the motor (driver) because of the registers of the C-Frame.
8. Install the spacer coupling between the shafts. Tighten the screws of each half coupling to secure them to the spacer coupling.
9. Make sure that the rotor is able to turn with no major resistance.

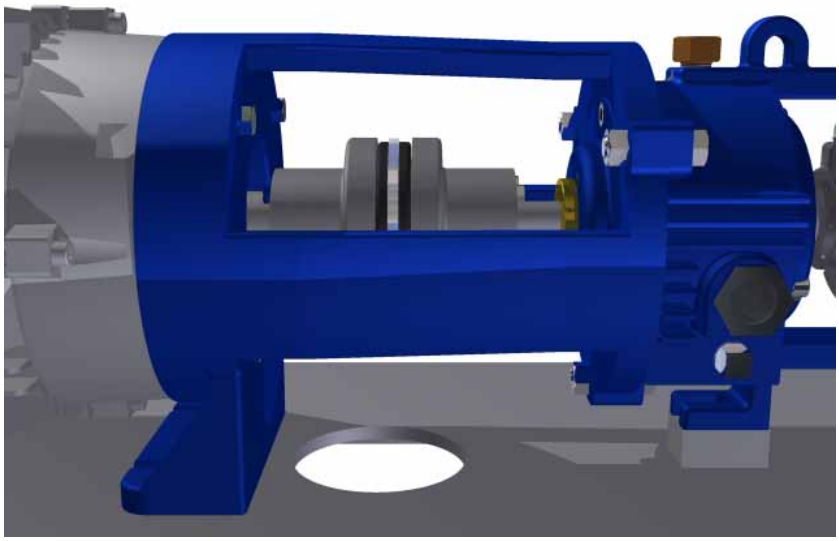


Figure 8.76. Verifying rotation of the rotor.

SECTION NINE - SPARE PARTS

The recommended quantity of spare parts to meet regular conditions of constant operation over a period of two years are given in the list below:

Spare parts	**Number of identical pumps (including reserve pumps)**						
	2	3	4	5	6 and 7	8 and 9	10 and more
	Quantity of spare parts						
Impeller	1	1	1	2	2	3	30%
Case wear ring (optional), impeller wear ring (optional)	2	2	2	3	3	4	50%
Adapter ring	2	2	2	3	3	4	50%
Shaft with coupling key	1	1	2	2	2	3	30%
Bearing	1	1	2	2	3	4	50%
Axial (thrust) cover (CPP21) or Axial (thrust) bearing carrier (CPP-L) & Radial bearing cover	1	1	1	2	2	3	30%
Bearing frame complete with shaft, bearings, etc.	-	-	-	-	-	1	2
Gasket for pump case (Sets)	4	6	8	8	9	12	150%
O-ring	2	3	6	8	8	10	150%
Repair Kit for mechanical seal	1	1	2	2	2	3	30%
Circlip (CPP-L)	1	1	2	2	2	3	30%

The spare parts should be available from the time of first operation.

Spare parts taken out and used must be replaced as soon as possible.

Please give the following details when ordering:

- Order No. of the pump
- Type of pump and size
- Identity number from the list of spare parts
- Part number from the sectional drawing
- Quantity

Material Storage of spare parts

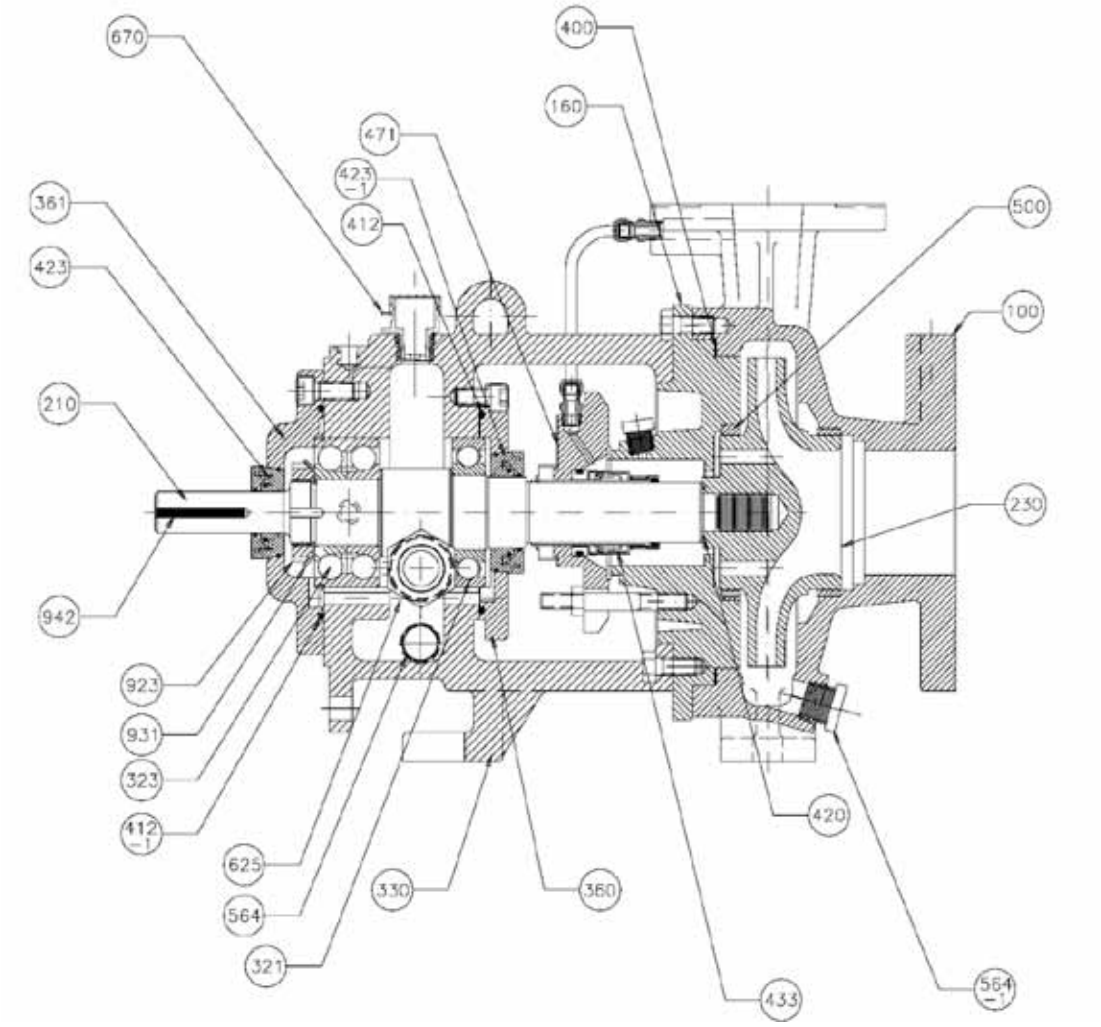
- Store the spare parts in their original packaging.
- Store in a dry place, preferably at a constant temperature.
- Check the spare parts and the state of the packaging every 6 months for signs of corrosion.
- Repair any damage or sign of corrosion with anticorrosive agents.

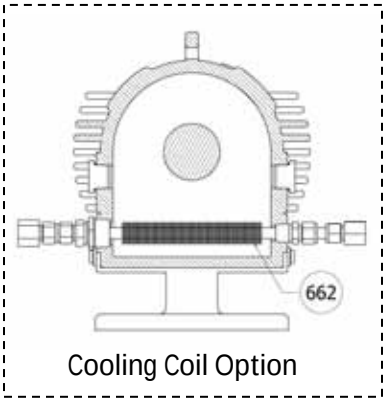
SECTION TEN - PARTS INFORMATION

CPP21 Bearing Frame: B-10

100	Case
160	Case Cover
210	Shaft
230	Impeller
321	Ball Bearing
323	Angular Contact Ball Bearing
330	Bearing Frame
360	Radial Bearing Cover
361	Axial Bearing Cover
400	Case Gasket
412	Radial Cover O-Ring
412-1	Axial Cover O-Ring
420	Impeller O-Ring

423	Axial Labyrinth Seal
423-1	Radial Labyrinth Seal
433	Mechanical Seal
471	Mechanical Seal Head
500	Adapter Ring
564	Bearing Frame Plug
564-1	Case Drain Plug
625	Oil Sight
662	Cooling Coil
670	Breather
923	Bearing Lock Nut
931	Bearing Lock Washer
942	Key



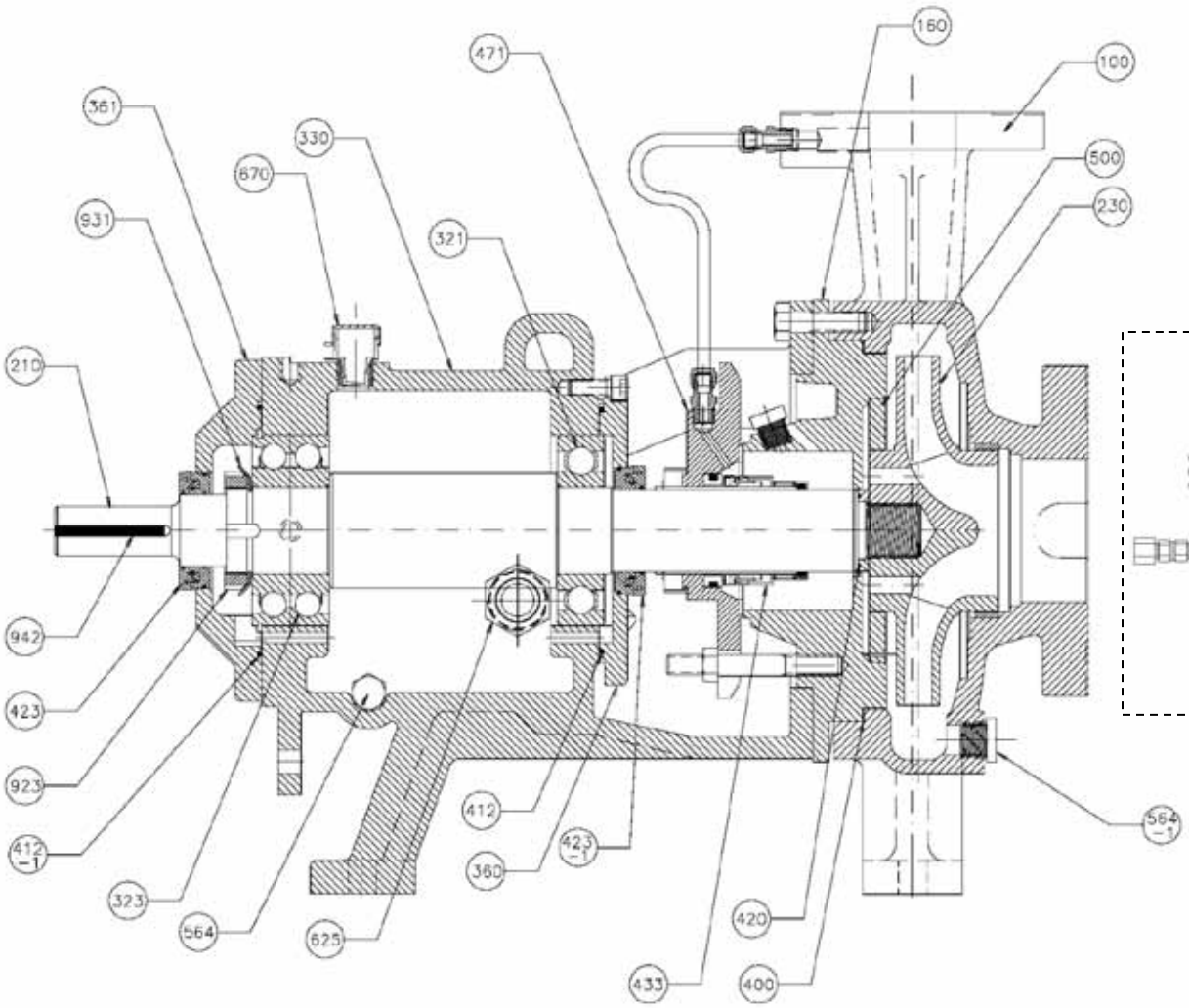


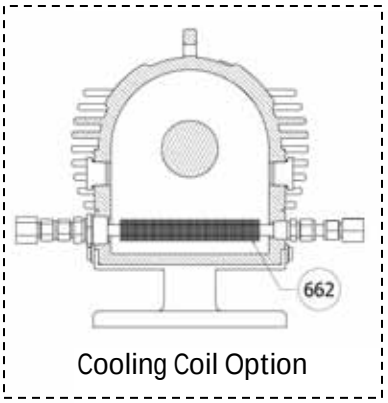
Cooling Coil Option

CPP21 Bearing Frame: B-30A / B-30B

100	Case
160	Case Cover
210	Shaft
230	Impeller
321	Ball Bearing
323	Angular Contact Ball Bearing
330	Bearing Bracket
360	Radial Bearing Cover
361	Axial Bearing Cover
400	Case Gasket
412	Radial Cover O-Ring
412-1	Axial Cover O-Ring
420	Impeller O-Ring

423	Axial Labyrinth Seal
423-1	Radial Labyrinth Seal
433	Mechanical Seal
471	Mechanical Seal Head
500	Adapter Ring
564	Bearing Frame Plug
564-1	Case Drain Plug
625	Oil Sight
662	Cooling Coil
670	Breather
923	Bearing Lock Nut
931	Bearing Lock Washer
942	Key



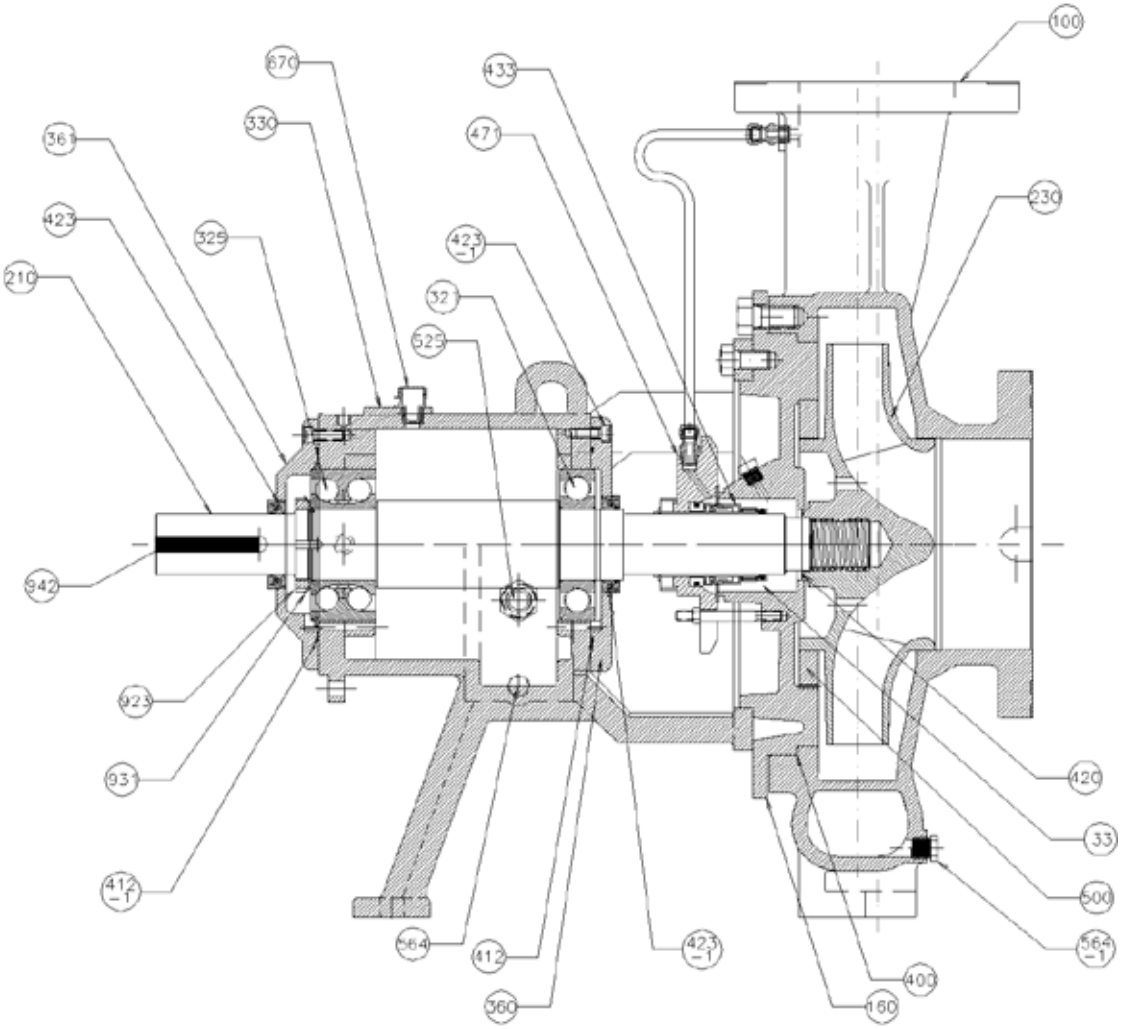


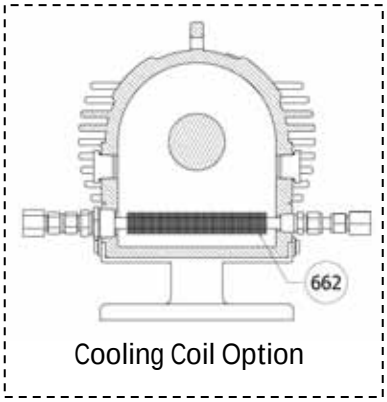
Cooling Coil Option

CPP21 Bearing Frame: B-50

100	Case
160	Case Cover
210	Shaft
230	Impeller
321	Ball Bearing
323	Angular Contact Ball
330	Bearing Bracket
360	Radial Bearing Cover
361	Axial Bearing Cover
400	Case Gasket
412	Radial Cover O-Ring
412-1	Axial Cover O-Ring
420	Impeller O-Ring

423	Axial Labyrinth Seal
423-1	Radial Labyrinth Seal
433	Mechanical Seal
471	Mechanical Seal Head
500	Adapter Ring
564	Bearing Frame Plug
564-1	Case Drain Plug
625	Oil Sight
662	Cooling Coil
670	Breather
923	Bearing Lock Nut
931	Bearing Lock Washer
942	Key



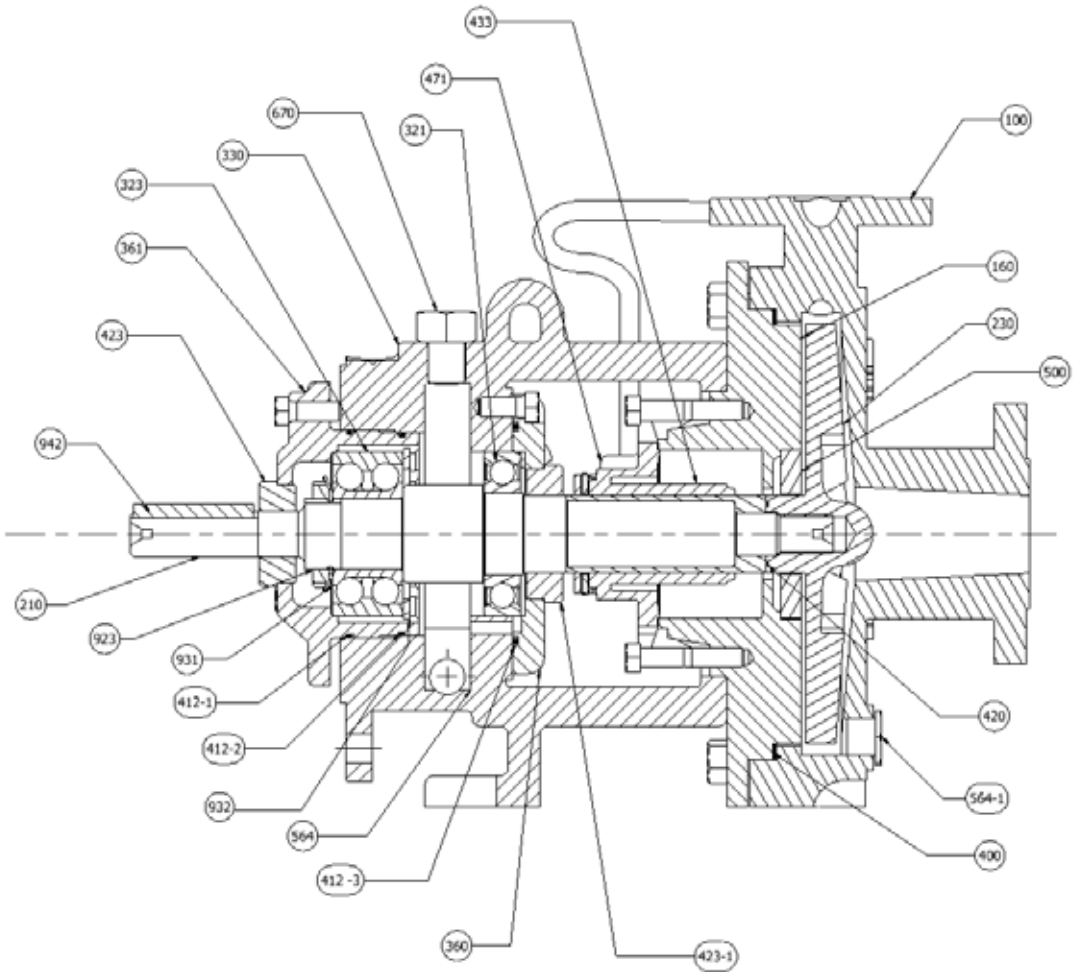


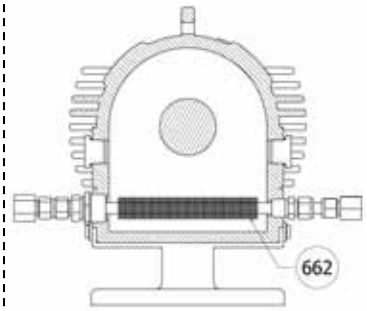
Cooling Coil Option

CPP-L Bearing Frame: B-10

100	Case
160	Case Cover
210	Shaft
230	Impeller
321	Ball Bearing
323	Angular Contact Ball Bearing
330	Bearing Bracket
360	Radial Bearing Cover
361	Axial Bearing Cover
400	Case Gasket
412-1	Axial Cover O-Ring Outer
412-2	Axial Cover O-Ring Inner
412-3	Radial Cover O-Ring
420	Impeller O-Ring

423	Axial Labyrinth Seal
423-1	Radial Labyrinth Seal
433	Mechanical Seal
471	Mechanical Seal Head
500	Adapter Ring
564	Bearing Frame Plug
564-1	Case Drain Plug
662	Cooling Coil
670	Breather
923	Bearing Lock Nut
931	Bearing Lock Washer
932	Circlip
942	Key



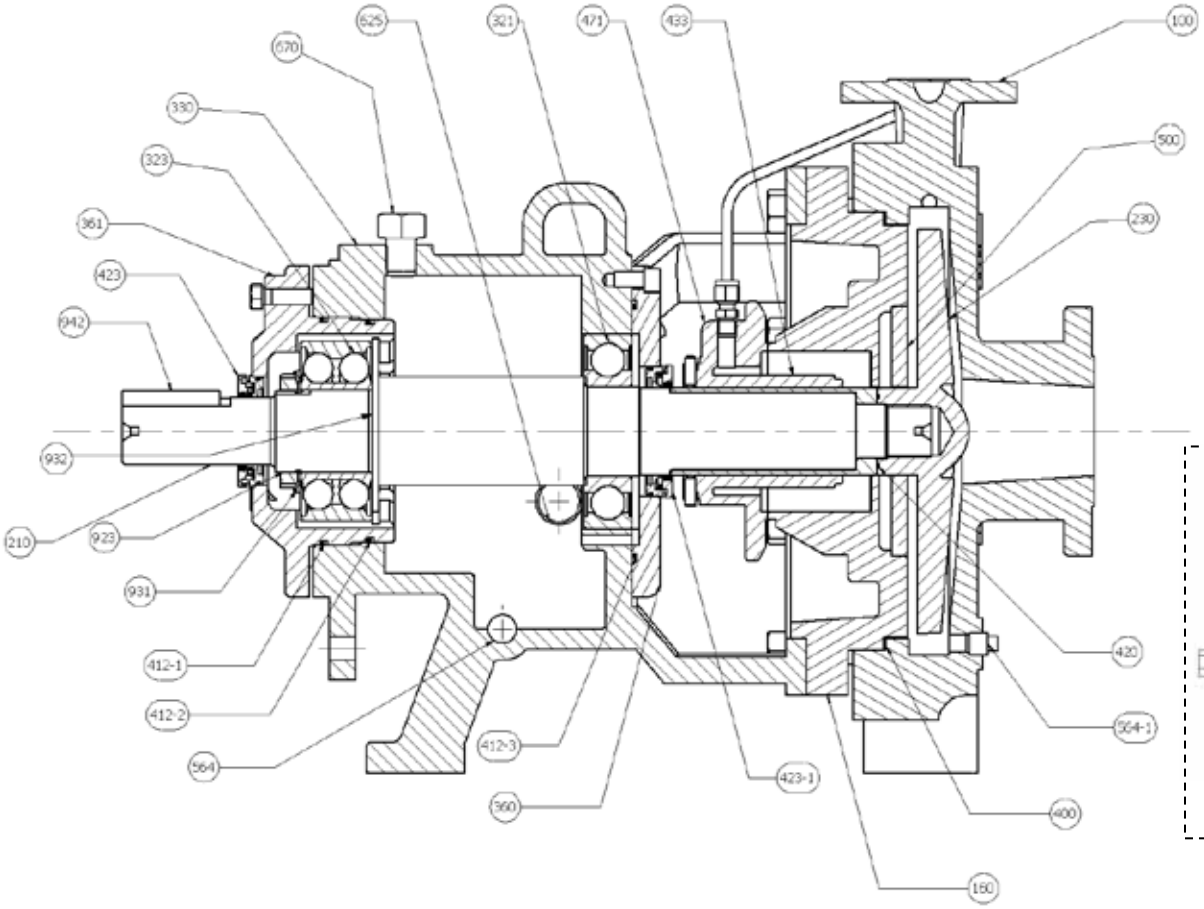


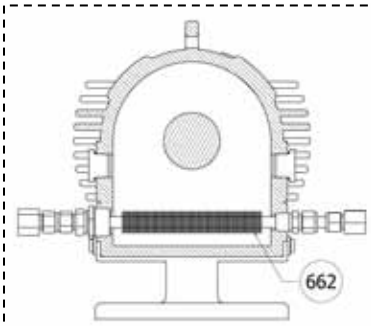
Cooling Coil Option

CPP-L Bearing Frame: B-30B

100	Case
160	Case Cover
210	Shaft
230	Impeller
321	Ball Bearing
323	Angular Contact Ball Bearing
330	Bearing Bracket
360	Radial Bearing Cover
361	Axial Bearing Cover
400	Case Gasket
412-1	Axial Cover O-Ring Outer
412-2	Axial Cover O-Ring Inner
412-3	Radial Cover O-Ring
420	Impeller O-Ring

423	Axial Labyrinth Seal
423-1	Radial Labyrinth Seal
433	Mechanical Seal
471	Mechanical Seal Head
500	Adapter Ring
564	Bearing Frame Plug
564-1	Case Drain Plug
625	Oil Sight
662	Cooling Coil
670	Breather
923	Bearing Lock Nut
931	Bearing Lock Washer
932	Circlip
942	Key





Cooling Coil Option

SECTION ELEVEN - TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSES	SUGGESTED SOLUTION
HOT BEARINGS	a. Insufficient Oil b. Contaminated Oil c. Misalignment d. Too much oil e. Pump is under tension stress f. Excessive axial thrust g. The given half-coupling spacing is not set h. Bearings are damaged	a. Add Oil. b. Drain and clean reservoir. Refill with clean oil. c. Check alignment of pump and driver. d. Drain to proper level. e. Check the piping for tension free connections. f. Clean balance holes in the impeller and change the seal rings. g. Reset and give the correct spacing. h. Change damaged bearings.
LEAKAGE UNDER SHAFT SLEEVE	a. Shaft seal is damaged b. Pump unit is not properly aligned c. The given half-coupling spacing is not set	a. Replace damaged seal. b. Realign the pump. c. Reset and give the correct spacing.
PUMP DOES NOT DELIVER LIQUID	a. Inner pump parts are worn b. Density or viscosity of pumped fluid is not same as designed c. The motor voltage is incorrect d. Motor runs only in two phase mode e. Pump not primed f. Speed too low g. Feed pipe or impeller plugged h. Clogged suction i. Damaged impeller j. Wrong rotation k. Pump or piping are not properly vented l. Formation of air pockets in the piping m. The counter pressure of the system is greater than the design point of the pump n. NPSHa too low	a. Change worn parts. b. Consult a Ruhrpumpen dealer. c. Apply correct voltage to the motor. d. Check the cables, connections and fuses. e. Prime pump. f. Check driver input. g. Clean pipe and impeller. h. Clean out suction line. i. Replace impeller. j. Check driver rotation. k. Vent or top up. l. Install vent valve or lay piping elsewhere. m. Open discharge valve as wide as necessary to reach the operating point. n. Check the fluid level in the feed container. Open suction valve completely. Lay suction pipe elsewhere is friction losses are too big. Check for a possible filter in the feed pipe.

TROUBLE	PROBABLE CAUSES	SUGGESTED SOLUTION
CAPACITY OR DISCHARGE PRESSURE LOW	a. Air leaks into suction b. Speed too low c. Clogged suction d. Clogged impeller e. Damaged impeller f. Wrong rotation g. Pump or piping are not properly vented h. Feed pipe or impeller plugged i. Formation of air pockets in the piping j. Inner pump parts are worn k. Density or viscosity of pumped fluid is not same as designed. l. The motor voltage is incorrect m. Motor connected only in two-phase mode n. NPSHa too low	a. Check suction line for leaks. b. Check driver and its power source. c. Clean out suction line. d. Clean impeller. e. Replace impeller. f. Check driver rotation. g. Vent or top up. h. Clean pipe and impeller. i. Install vent valve or lay piping elsewhere. j. Change worn parts. k. Consult a Ruhrpumpen dealer. l. Apply correct voltage to the motor. m. Check the cables, connections and fuses. n. Check the fluid level in the feed container. Open suction valve completely. Lay suction pipe elsewhere is friction losses are too big. Check for a possible filter in the feed pipe.
DRIVER OVERLOAD	a. Density or viscosity of pumped fluid is not same as designed b. Speed too high c. Pump unit is not properly aligned d. Pump is under tension e. The motor voltage is incorrect f. Motor connected only in two-phase mode g. Bearings are damaged h. System head lower than rating	a. Consult a Ruhrpumpen dealer. b. Decrease driver speed. c. Realign the pump. d. Check the piping for tension-free connections. e. Apply correct voltage to the motor. f. Check the cables, connections and fuses. g. Change damaged bearings. h. Check suction and discharge pressure. Set operating point with the discharge valve.

USA

RUHRPUMPEN, Inc.
4501 South 86th East Ave.
Tulsa, Oklahoma 74145 USA
Phone:+1 (918) 627-8400

GERMANY

RUHRPUMPEN GmbH
Stockumer Strasse 28
58453 Witten/Germany
P.O. BOX 6309
58432 Witten/Germany
Phone: +49 (2302) 661-03

MEXICO

RUHRPUMPEN S.A. de C.V.
Níquel No. 9204
Ciudad Industrial Mitras
García, NL México 66000
Phone: +52 (81) 8158-5500

EGYPT

RUHRPUMPEN Egypt
2 New Marwa Building
Ahmed Tayssir Str. 2nd Floor
Heliopolis Cairo, Egypt
Phone: +20 (02) 2290-5246

ARGENTINA

RUHRPUMPEN S.A.
Oliden 3177 | C1439FNG
Buenos Aires, Argentina
Tel: +54 (11) 4115-7867

May 2012

RUHRPUMPEN PLANTS

GERMANY, Witten

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INDIA, Chennai

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info@ruhrpumpen.com www.ruhrpumpen.com